Australian Government

Department of Defence
Defence Science and
Technology Organisation

DSTO Annual Review
2013-14

Electronics engineer Daniel Kauter working on a hypersonic glider for HIFiRE 4 trial.

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DSTO | Science and Technology for Safeguarding Australia

Abbreviations and acronyms

ADF	Australian Defence Force
AEW&C	Airborne Early Warning and Control
AMCU	Australian Multicam Camouflage Uniform
ASRAAM	Advanced Short Range Air to Air Missile
ATSB	Australian Transport Safety Board
CBRN	Chemical, Biological, Radiological and Nuclear
CDS	Chief Defence Scientist
CMD&V	Countermeasure Development and Validation
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTD	Capability and Technology Demonstrator
DCDS	Deputy Chief Defence Scientist
Defence	The Defence organisation, including the Department of Defence and the Australian Defence Force
DIF	Defence Innovation Forum
DIO	Defence Intelligence Organisation
DIRF	Defence Innovation Realisation Fund
DMO	Defence Materiel Organisation
DMTC	Defence Materials Technology Centre
DPCU	Disruptive Pattern Combat Uniform
Dstl	Defence Science and Technology Laboratory
DSTO	Defence Science and Technology Organisation
DVG	Digital Video Guard
GPU	General Purpose Uniform
HQJOC	Headquarters Joint Operations Command
ICT	Information and Communication Technology
IED	Improvised Explosive Device
IP	Intellectual Property
ISR	Intelligence, Surveillance and Reconnaissance
JORN	Jindalee Operational Radar Network
JSF	Joint Strike Fighter
MoU	Memorandum of Understanding
MSTC	Major Science and Technology Capabilities
NATO	North Atlantic Treaty Organization
Navy	Royal Australian Navy
NICTA	National Information and Communications Technology Australia
NRL	Naval Research Laboratory
OTHR	Over-the-horizon radar
R&D	Research and Development
RAAF	Royal Australian Air Force
RAM	Radar Absorbing Material
RPDE	Rapid Prototyping, Development and Evaluation
S&T	Science and Technology
SMiS	Scientists and Mathematicians in Schools
SOCOMD	Special Operations Command
SOER	Special Operations Engineering Regiment
STEM	Science, Technology, Engineering and Mathematics
TTCP	The Technical Cooperation Program (TTCP)

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Front cover main image
Research scientists Jemma Coleman and Sheena Davis measuring a mannequin for anthropometric research.

Back cover main image
Researchers Mai-Chi Nguyen and Dr Chris Ellis observing Computational Fluid Dynamics flow modelling of a submarine.

Inside the DSTO **Annual Review 2013-14**

Overview from the **Chief Defence Scientist**

The year 2013-14 has been a time of significant change for DSTO. We have a new government, a new Minister, and a political, economic, social and technological landscape that is evolving rapidly.

This changing external environment coincides with significant internal reform for DSTO. We are one year into the recalibration of our strategic direction and the implementation of our five-year strategic plan 2013-18. The strategic plan was an important first step in positioning us to meet current and future challenges for Defence and national security. One of the key developments was the re-prioritisation of a client-focused science and technology program, the streamlining of the DSTO organisation structure and the rationalisation of DSTO's major science and technology capabilities.

In terms of implementing the strategic plan, we have made notable progress which has been captured in this Annual Review.

While it has been a year of unprecedented transformation with budgetary and resource constraints, DSTO has continued to deliver exceptional support to Defence and national security.

Our performance during 2013-14 has been strong in each of our core roles – support to operations, sustainment, acquisition, future-proofing and national security.

We have been highly responsive in meeting priority operational demands by providing innovative solutions for the protection of Australian troops in combat zones and equipping them with effective capabilities. Our program of through-life support for Defence assets continues to deliver significant cost savings and enhanced capabilities.

In support of the Defence Capability Plan we have been engaged in a range of ongoing studies and research to inform the acquisition of major assets including the Future Submarine, the Joint Strike Fighter, the Future Frigate and Land mobility vehicles.

With an eye to the future, we are investigating game-changing evolving technologies such as hypersonics and autonomous systems for Defence capability. This is part of our strategic research investment into high-impact areas and is underpinned by a study of emerging threats and opportunities. DSTO has produced *Forward 2035*, a study of new socio-economic trends and their implications for future Defence capability, critical work which will inform the next Defence White Paper.

During the year DSTO took the lead in advancing the whole-of-government initiative to better coordinate science and technology in support of national security. The result was a policy framework and a science and technology program for national security, which awaits government approval in 2014-15.

DSTO alone cannot deliver all the technology solutions that Defence needs. Collaboration and partnerships are vital in accessing a wide range of technologies for Defence and national security. During the last two years we have reinvigorated our external engagement drive and entered into ten strategic alliances with defence companies and government research agencies. As well, we introduced a new defence science partnerships model for universities, resulting in agreements with 22 major and regional Australian higher education institutions. To deliver high-impact outcomes for Defence, these alliances and agreements are designed to work as genuine partnerships rather than client-provider arrangements as in the past.

On the international front we have strengthened our relationships with Singapore by adding new areas for research collaboration. In a historic first, we also paved the way for collaboration on hydrodynamics research with Japan in 2015 following the recently signed Australia-Japan Agreement on the Transfer of Defence Equipment and Technology. Next year will also see the finalisation of a defence science Memorandum of Understanding with the Republic of Korea. With our traditional partners in The Technical Cooperation Program we have jointly agreed to implement the concept of enhanced mutual reliance to make better use of our combined capabilities.

To support DSTO's engagement activities, there was a renewed focus on communication backed by our new digital strategy. This has resulted in a redeveloped public website, a new DSTO 'app' and the digitisation of the staff magazine *Connections*.

At the beginning of 2014 the National Commission of Audit presented its report to government. One of its recommendations was to explore the potential for outsourcing DSTO. The First Principles Review, which is looking more widely into Defence, is also examining this recommendation. DSTO has presented a submission to the Review team, outlining the case for DSTO to remain a government-owned entity within Defence.

In a fast-changing technology environment with added financial constraints Defence will be relying more and more on DSTO's impartial advice, our ability to interpret the ADF's operational needs in technology terms and our proven expertise in applying science to solve practical Defence problems.

Our scientists continue to be recognised for the high quality of their work, particularly from international organisations in the USA and Europe, including NATO and the US Department of Defense. Such recognition is a measure of the scientific excellence we deliver to Defence.

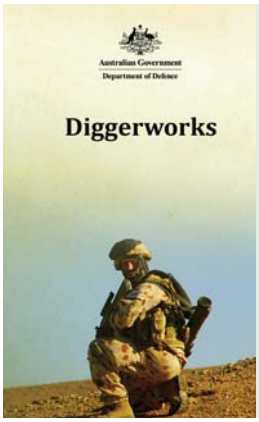
DSTO's strong performance is due to the dedicated efforts of our people. I thank all our staff for their contributions to make DSTO a better organisation – those who deliver scientific excellence for quality client outcomes and those who support their colleagues to make it happen.

Dr Alex Zelinsky
Chief Defence Scientist
December 2014

Major highlights for clients

Airborne self-protection
DSTO was a key member of the ADF's Australian Airborne Countermeasures team which received the 2013 Prime Minister's Award for Excellence in Public Sector Management for establishing an enduring and sustainable airborne self-protection capability.

Counter-IED systems
DSTO developed durable, low cost, lightweight and weather resistant specialised force protection systems to protect frontline troops from improvised explosive devices.



Equipping troops for combat
DSTO completed a study on the success of Diggerworks which has vastly improved the way Australian soldiers are equipped for combat.

Surface fleet paint schemes
DSTO provided expert advice on the repainting of the Navy's surface fleet to ensure the new coatings would meet modern warfighting and regional environmental conditions.

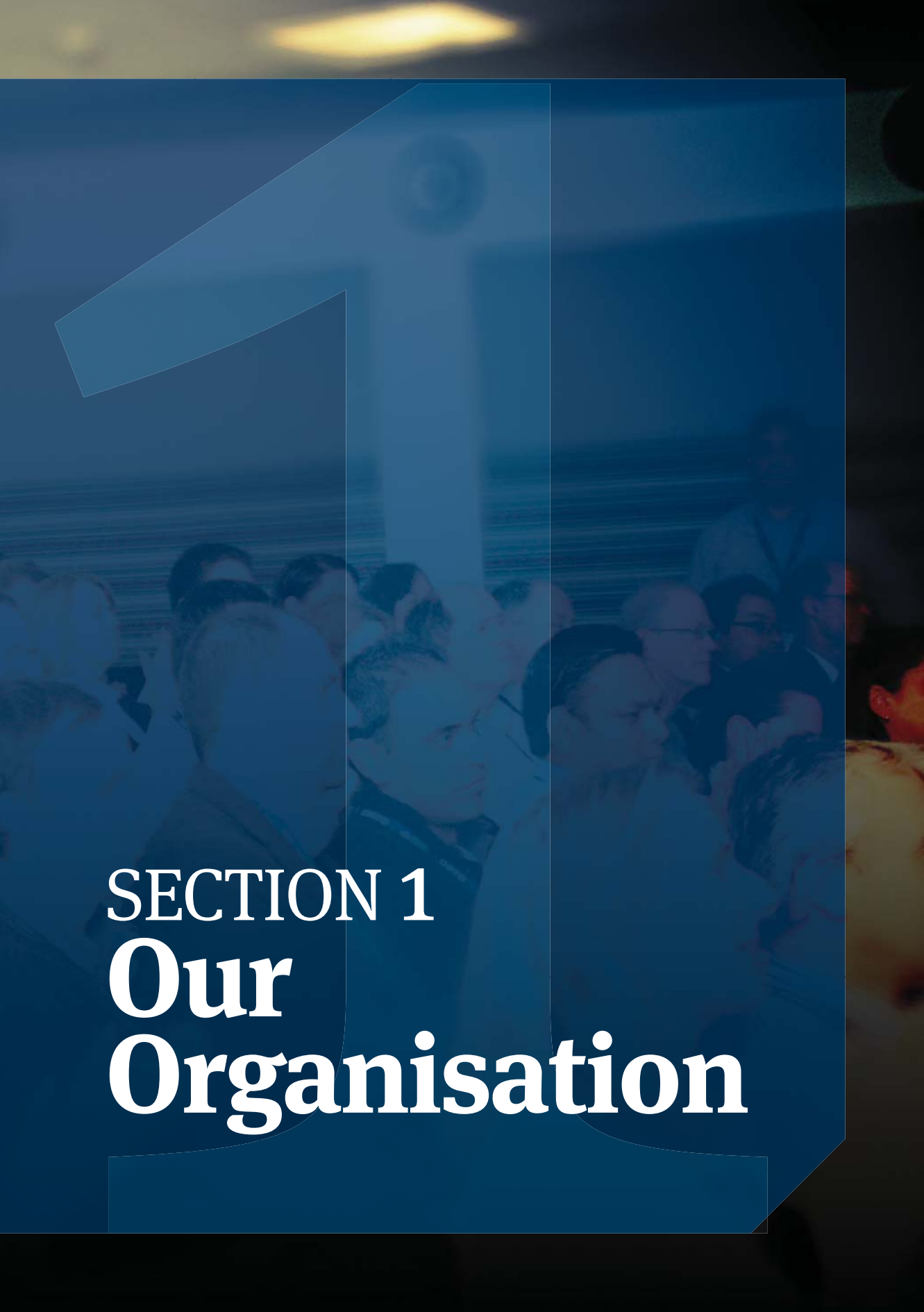
Next-generation uniform
In collaboration with its Defence and industry partners, DSTO developed the Australian Multicam Camouflage Uniform (AMCU) to replace the current Disruptive Pattern Combat Uniform (DPCU). The new uniform represents the next generation of field and combat uniforms for Australian soldiers.

Foresighting study
DSTO undertook the *Forward 2035* foresighting study to examine emerging trends in the socio-economic landscape and identify the strategic global factors that may impact future developments in science and technology, and shape long-term Defence capability requirements.

Iron Bird model of Joint Strike Fighter
DSTO developed and commissioned a full-scale model of the F-35A Joint Strike Fighter to investigate the effects of electromagnetic interference on the aircraft. Defence Minister Senator David Johnston and Air Vice Marshal Kym Osley unveiled the model at DSTO Edinburgh.

Search for Malaysia Airlines aircraft
DSTO provided invaluable advice and analysis to the international team of experts brought together to search for the missing Malaysian aircraft, MH370.

Organisational restructure
DSTO reshaped its organisational structure for better alignment with Defence requirements and improved client outcomes.



SECTION 1
Our Organisation

About **DSTO**

Defence science has been conducted in Australia since 1907 and today DSTO is the nation's second-largest publicly funded research agency. Over the past century, DSTO has consistently stepped up to find new and innovative scientific and technological solutions to safeguard Australia and its national interests.

Headed by the Chief Defence Scientist, Dr Alex Zelinsky, DSTO has an annual budget of approximately $408 million and employs around 2300 staff, predominantly scientists, engineers, IT specialists and technicians.

DSTO has a permanent presence in nearly every state and territory in Australia. Internationally, it has liaison offices in Washington DC, London and Tokyo, and research scientists located around the world, working on postings, exchanges, fellowships and joint research projects. A small number of DSTO personnel operate in combat zones, providing direct support to Australian operations.

DSTO's **purpose**

DSTO exists to provide the Australian Government with scientific advice and innovative technologies to meet Australia's Defence and national security challenges.

Its core roles are focused on supporting Australian troops on the ground, sustaining and enhancing existing Defence capabilities, ensuring Defence is a smart buyer of Defence equipment and future-proofing Defence to ensure that the Australian Defence Force (ADF) can meet the challenges of the future.

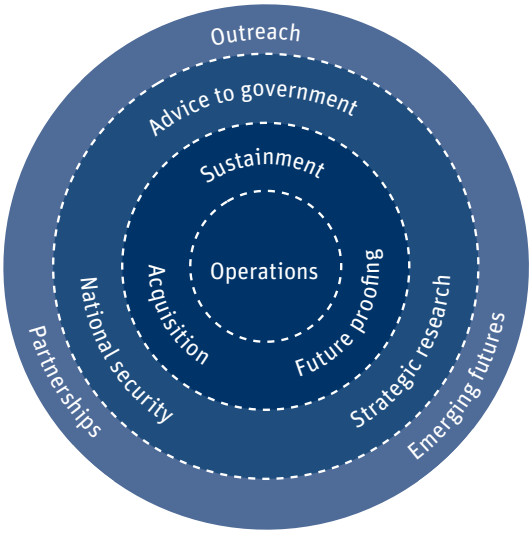
DSTO also has a role in providing expert, impartial advice to government on defence and national security matters, as well as coordinating the delivery of whole-of government science and technology support for national security.

As a science and technology organisation DSTO conducts strategic research to identify high-impact areas for Defence and monitor emerging technologies to assess their potential impact on Defence capability.

Underlying all of its activities is an increased emphasis on external engagement and collaboration. This includes taking a stronger role in knowledge and innovation integration, strengthened through partnerships with industry and academia.

DSTO's **roles**

CORE	
Role	**Description**
Operations	Supporting operational capability with science and technology expertise.
Sustainment	Providing support to Defence to sustain and enhance current capability.
Acquisition	Providing support throughout the genesis, development, acquisition and introduction into service of major capability projects.
Future proofing	Investigating client-focused future concepts, contexts and capability.
EXTENDED CORE	
Role	**Description**
Advice to government	Shaping defence and national security strategic policy through expert and impartial advice.
National security	Leading the coordination and delivery of science and technology to enhance whole-of-government national security.
Strategic research	Conducting research into high-impact areas for future Defence capability.
SUPPORTING	
Role	**Description**
Emerging futures	Scanning the environment to gain an understanding of emerging science and technology threats and opportunities.
Partnerships	Enhancing its impact by collaborating with research and industry partners, nationally and globally.
Outreach	Promoting defence science and education in the broader Australian community.



DSTO Leadership Team 2013-14

Dr Alex Zelinsky
Chief Defence Scientist

Dr Ian Sare
Deputy Chief Defence Scientist Strategy and Program

Dr Warren Harch
Deputy Chief Defence Scientist Partnerships and Outreach

Mr Peter Lambert
Deputy Chief Defence Scientist Research Services

Ms Janis Cocking
Chief Maritime Division

Dr Simon Oldfield
Chief Land Division

Dr Ken Anderson
Chief Aerospace Division

Dr Todd Mansell
Chief Joint and Operations Analysis Division

Dr Tony Lindsay
Chief National Security and Intelligence, Surveillance and Reconnaissance Division

Dr Jackie Craig
Chief Cyber and Electronic Warfare Division

Dr John Riley
Chief Weapons and Combat Systems Division

Vision, purpose, people and values

Our vision

DSTO aims to be a world leader in defence science and technology – indispensable in supporting and transforming Australia's defence and national security.

Our purpose

DSTO is a national leader in safeguarding Australia by delivering valued scientific advice and innovative technology solutions for Defence and national security.

Our people

DSTO has diverse, professional and specialised staff members who work in offices, complex laboratories, test facilities, weapons ranges and operational theatres. DSTO provides a work experience that is both challenging and career-developing and treats a safe, healthy and secure working environment as a key priority.

Our values

The following set of DSTO values guide our behaviour and decision-making and help us to demonstrate the attitudes and actions for organisational success.

Excellence in science
We strive to lead, and be proud of, all our scientific undertakings.

People
We develop and support each other to achieve organisational deliverables in a safe environment.

Professionalism
We strive for excellence in everything we do.

Loyalty
We are committed to each other, our leaders and the organisation.

Integrity
We are trustworthy and honourable in all our interactions.

Courage
We act with strength of character, both in the courage of our convictions and in our intellectual courage.

Innovation
We actively and consistently look for better ways of doing business.

Teamwork
We work together with trust, respect and a sense of collective purpose.

DSTO's **strategic plan**

The DSTO Strategic Plan 2013-18 sets the high-level direction for DSTO over a five-year period. Under the strategy, DSTO builds on its strength as a ***valued adviser*** to government and focuses its efforts on building future Defence and national security capability by being a ***collaborative partner*** and an ***innovation integrator***.

The plan identifies ten strategic initiatives to ensure that DSTO remains a leader in Defence science and technology by:

- Ensuring science and technology excellence by investing in people and facilities
- Undertaking strategic engagement with a client focus by prioritising client requirements and improving program delivery
- Conducting big picture analysis on the shape of Defence to influence whole-of-Defence strategy and capability
- Taking on the grand challenges for safeguarding Australia by conducting high-impact, complex, multi-disciplinary programs of national significance
- Fostering innovation across the Defence enterprise to assist in the rapid transition of ideas into capability
- Invigorating Australia's research efforts in national security by coordinating and delivering science and technology to non-Defence national security agencies
- Developing leadership, accountability, and performance management for improved governance
- Enhancing talent, diversity and career development for current and future staff
- Transforming ICT to drive innovation and collaboration by exploiting leading-edge technologies
- Implementing best practices for business processes and administration to achieve greater efficiencies

"I've worked very closely with DSTO over many years and I consider DSTO, for me, has always delivered, therefore, you've always got my support in what we've been doing."

Air Chief Marshal Mark Binskin, AC
Chief of the Defence Force
at the DSTO Strategic Context Seminar, 2014

Strategic Plan **implementation**

One year into the implementation of the plan, DSTO has made promising progress.

Changes to structure and client program

DSTO has reshaped itself to align with and support the delivery of science and technology to Defence. Eleven research divisions were reduced to seven divisions while corporate functions were brought under the leadership of three Deputy Chief Defence Scientists responsible for Strategy and Program, Partnerships and Outreach, and Research Services.

A prioritised client program was put in place to be more responsive to Defence requirements. This included changes to the roles and responsibilities for engaging with clients. Under the new client-facing structure, DSTO implemented a single consistent way of organising its skills and expertise using its major science and technology capabilities as the fundamental unit of organisation. Each major science and technology capability is a unique combination of a science discipline and a defence domain, and has now become a formal part of DSTO's organisation structure.

DSTO is currently in the process of prioritising its major science and technology capabilities to reflect the value of individual capabilities to Defence. A separate benchmarking exercise is assessing the health of these capabilities to balance resource allocation and grow those scientific capabilities that will best serve Defence in the future.

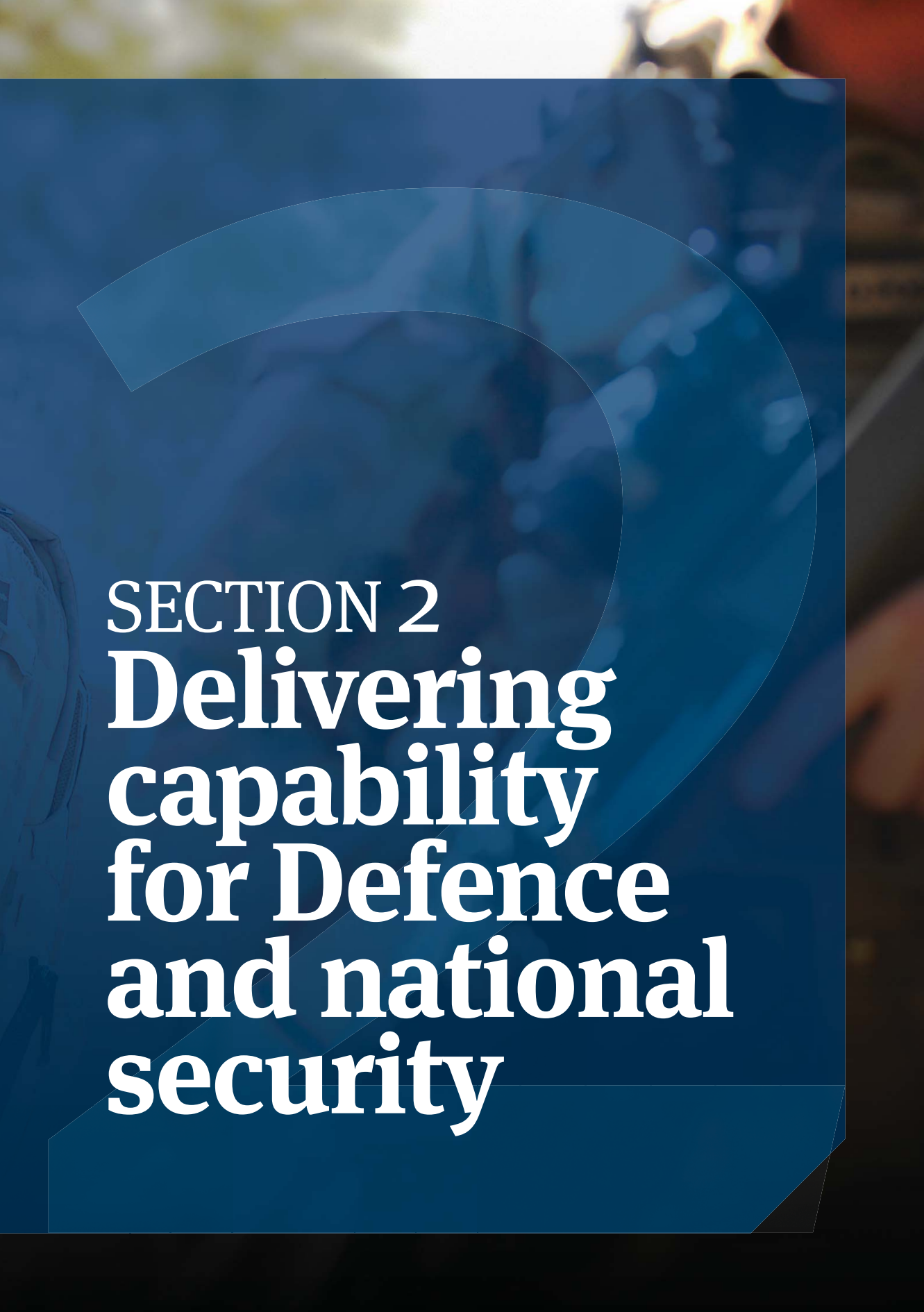
These changes were made to ensure that DSTO is more efficient, client-focused and better organised to achieve science and technology excellence in support of Defence.

Significant improvements were also made to DSTO's ICT systems, governance and processes. This included a wireless internet network to conduct unclassified research, expanded videoconferencing systems and enhanced access to electronic scientific resources and subscriptions. Some administrative processes were streamlined for greater efficiency.

DSTO forged strategic alliances with defence industry partners and government research agencies. As well, it established the Defence Science Partnerships program, a framework that enables Australian universities to work in a coordinated way with Defence and national security agencies on collaborative research projects.

As part of its role to drive and coordinate innovation within the Department, DSTO set up the Defence Innovation Realisation Fund for the further development of already-proven technology concepts. A Defence Innovation Forum was also organised, bringing together participants from industry, academia, research agencies and Defence to discuss the way forward on improving the transition of innovative ideas to capability.

Under its responsibilities for national security, DSTO took the lead in developing a draft policy framework in consultation with other government agencies. Workshops were held to agree on a governance model and science and technology priorities for national security.



SECTION 2

Delivering capability for Defence and national security

Supporting our **troops on the ground**

DSTO's number one priority is to support Australian troops undertaking military operations around the world. DSTO's support and advice in this area help to ensure that missions are conducted safely and successfully.

In addition to providing behind-the-scenes support, DSTO scientists are often deployed on military operations to provide immediate, on-the-ground advice and assistance. In the past year, DSTO deployed nine operations analysts to the Middle East Area of Operations and six "fly-away" teams of technical experts rapidly assembled and deployed to solve an immediate or urgent problem.

Assistant Minister for Defence Stuart Robert inspects helmets at the Diggerworks laboratory in Melbourne.

Diggerworks

In 2013, DSTO and its Defence partners commissioned a case study that provides valuable insights into the success of Diggerworks, a joint initiative involving DSTO, Army, the Defence Materiel Organisation and Capability Development Group. Diggerworks was formed to enhance the delivery of technology and equipment to frontline soldiers. Since its inception, Diggerworks has revolutionised the way that Defence equips its soldiers for combat. With Diggerworks it has been possible to field combat system enhancements in a much more rapid and responsive manner than was possible previously.

Besides serving as a model of cooperation within Defence, Diggerworks established strong collaborative relationships with a range of industry and academic partners including CSIRO, the Defence Materials Technology Centre, Australian Defence Apparel, the University of Melbourne and Swinburne University of Technology.

By identifying the factors that contributed to Diggerworks success, the study (*Diggerworks: Driving Innovation and Effectiveness in the Defence Sector*) has positioned Defence to apply those lessons elsewhere within the ADF and achieve similar positive outcomes.

Barbara Szumulo and Rohit Naik, part of the team that developed the Redwing counter-IED solution.

Protection from explosive devices

In response to a request from the ADF Counter-IED Task Force, DSTO developed specialised protection systems under the REDWING Program to assist in countering the effects of improvised explosive devices (IEDs).

Currently, two systems have been developed: GREENGUM, a lightweight device for use by dismounted soldiers and GREYGUM which can be fitted to light vehicles.

These force protection systems are unique capabilities, designed to be durable, low cost, lightweight and weather resistant. The systems are about the size and shape of a small radio, incorporating a rechargeable battery and simple on/off switch operation.

Final production prototypes have been completed and the Australian Military Sales Office in the Defence Materiel Organisation is coordinating the commercialisation of the technology, including manufacture of the units. Several of Australia's international partners who are looking for protection against IEDs have expressed an interest in importing these systems.

Kendy Hau receives commendation from Lieutenant-General Ash Power.

Exploring cultural compatibility

To assist the Australian Defence Force develop a better understanding of the causes of possible inter-personal, cultural and operational friction between Australian and Afghan forces, DSTO scientist Kendy Hau undertook a study of cultural compatibility.

The study has helped improve the effectiveness of the ADF mentoring and assistance mission in Afghanistan and minimised the risk of further insider attacks. The work has been internationally recognised by Australia's coalition partners and its findings incorporated into formal NATO guidance documents.

Ms Hau was awarded a Gold Commendation from the Chief of Joint Operations Lieutenant General Ash Power for her involvement in this study.

Sustaining existing **Defence capability**

A significant proportion of DSTO's work is directed at sustaining and enhancing current capability. This work is aimed at improving the ADF's operational effectiveness, enhancing the safety of troops, maximising the availability of Defence platforms and minimising the cost of owning Defence assets.

Revised paint scheme for Navy surface fleet

DSTO undertook extensive research and provided expert advice on the revised coating scheme for the Navy's surface fleet. The new paint scheme (called Haze Grey) is more durable, less toxic, requires fewer repaints and is better suited to regional environmental conditions.

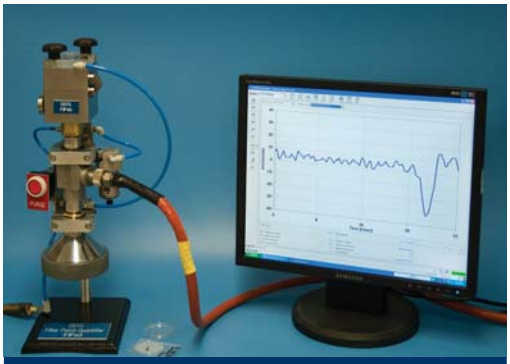
The Royal Australian Navy has traditionally used the Storm Grey colour based on the Light Grey colour which was developed for use in the northern hemisphere to reduce detection under largely overcast conditions.

The conditions are quite different (predominantly sunlit) in the waters around northern Australia where the Royal Australian Navy operates. These different conditions, coupled with advances in coating technology, led to the decision to adopt a more suitable paint scheme for the entire surface fleet.

DSTO's Probability of Detection tools, which it used to provide detailed advice on the effect that alternative paint schemes would have on detection range, have generated significant interest from international defence research organisations, including the Naval Research Laboratory in the United States.

Improved techniques to extract wear debris from aircraft systems

The day-to-day operation of aircraft results in the accumulation of wear debris in lubrication or hydraulic systems. Analysis of this debris can provide an excellent insight into the internal health of the system. However, the extraction and analysis of debris for military aircraft can be difficult because they are often deployed in remote locations and have no easy access to proper testing facilities. Inaccurate analyses can result in unsafe aircraft continuing to fly, or the unnecessary replacement of an engine or gearbox which is expensive, time-consuming and potentially counter to the best interests of both aircraft and aircrew.



Analysing engine wear debris.

DSTO is working to develop reliable tools that can be used in deployed environments to extract and accurately analyse wear debris. DSTO scientist Andrew Becker has been awarded a US patent for a device which enables maintenance crew in remote locations to quantify and capture wear debris and easily compare it against a manufacturer's safe limits.

DSTO is also leading an international effort to develop global standards for the extraction and assessment of filter debris, enabling laboratories worldwide to perform filter debris analysis in a consistent manner.

Geoff Harrison and Andrew Amiet test the performance of radar absorbing material for a submarine periscope mast.

Australian-made radar absorbing materials

DSTO has created an Australian capability to develop radar absorbing material for Navy platforms.

The purpose of radar absorbing material is to protect surface ships from attack by radar-guided missiles, as well as to reduce the radar detectability of submarine masts.

DSTO designed a new radar absorbing material for the masts of the Collins class submarines to overcome deficiencies of overseas-sourced material which was unsuited to Australian conditions. DSTO developed a hard-wearing rubber tile that offers maximum absorbing performance across the highest priority radar frequency bands.

Using Australian industry to manufacture the material, three attack periscope masts and seven search periscope masts have been treated with the DSTO material. The technology will not only benefit the Collins class submarines, the indigenous knowledge generated will be used as the basis for optimising the performance of future ships and submarines.

Missile simulation centre.

Missile support

DSTO scientists have been evaluating and supporting the Advanced Short-Range Air-to-Air Missile for many years, from the initial selection process through to its introduction into service.

Most recently, DSTO has developed new algorithms to enhance the ability of ASRAAM to acquire and maintain lock-on to target aircraft despite their deployment of new-generation infrared countermeasures.

The DSTO algorithms will be incorporated into a new missile software load being developed jointly by the UK and Australia. This is expected to result in a substantial improvement in weapon performance.

Multicam uniform field trial.

New Army camouflage pattern

In collaboration with its Defence and industry partners, DSTO played a key role in the development of Australia's new Multicam Camouflage Uniform (AMCU). DSTO provided the technical input to develop the colour sets, pattern layering and near-infrared signature capability. Several key issues were taken into account, including the need to address inflexible procurement deadlines, ensure manufacturing costs were optimised, retain the pattern colour weightings of the Disruptive Pattern Camouflage Uniform (DPCU) and maintain a national identity.

In response to Army requirements and critical procurement timelines, DSTO and Bruck Textiles Ltd produced the first industrial proof of concept within four weeks. As part of Diggerworks, DSTO then led a final, comparative field evaluation of the AMCU and the DPCU for camouflage effectiveness in northern Australia. This evaluation by military experts and users confirmed the camouflage capability of the AMCU to meet the performance requirements essential for both daytime and night time operations.

The AMCU exemplifies DSTO's highly adaptive signature management capability and its responsiveness in delivering essential science and technology to meet Defence outcomes.

RAAF members display current range of uniforms, including the General Purpose Uniform (two in foreground).

New look for Air Force

DSTO provided critical technical support to the development of a new General Purpose Uniform for the Air Force.

The Air Force required a uniform that provided an easily recognisable RAAF presence, particularly for general base duties and non-warlike operations such as humanitarian aid and assistance to the civilian community. The uniform needed to be consistent with the RAAF's identity, while still meeting functional service requirements.

DSTO's assistance and strong history with indigenous textile industries helped to drastically reduce the costs and time required for the development of the new concept.

The GPU was officially launched on 1 March 2014 at the Centenary of Military Aviation Air Show at RAAF Base Williams, Point Cook.

Early warning and control capability

DSTO was a key member of the multinational team that significantly improved the E-7A Wedgetail Airborne Early Warning and Control radar and tracking system. DSTO's extensive expertise and knowledge helped shape the system and transition it successfully into service. In particular, DSTO played a critical role in structural fatigue monitoring and develping training systems. It continues to work closely with RAAF's 42 Wing to improve tactics, techniques and procedures.

Optimising Navy's warfighting effectiveness

DSTO analysts embedded in the Australian Maritime Warfare Centre provide critical support to the Royal Australian Navyin optimising its warfighting effectiveness. In particular, they have been involved in enhancing Navy's anti-submarine warfare capability.

In 2013, DSTO analysts participated in Exercise Talisman Sabre. This exercise, involving the Australian and United States navies, was designed to test anti-submarine warfare concepts, improve tactics and investigate the effectiveness of anti-submarine enablers such as command and control, communications and planning tools.

Three DSTO observers were located on two ships to assist in data collection, gain a context for the tactical actions and conduct interviews with tactical commanders. Using the data collected, DSTO analysts were able to reconstruct events and develop a complete narrative of the exercise to determine the critical factors which influenced the exercise outcomes. The knowledge gained from DSTO's work will be invaluable in improving the Navy's anti-submarine warfare capability.

Investigating susceptibility to chemical warfare

During deployment, military personnel may be exposed to a wide variety of chemical compounds including chemical warfare agents, pesticides and drugs. In a pilot study, DSTO demonstrated that a number of ADF personnel carry genetic variations that may impact their sensitivity to chemical warfare agents and their response to pharmaceutical countermeasures.

The study showed that the medical management of ADF members could be improved by identifying susceptible individuals using a simple, non-invasive test procedure.

Inside the land vehicle simulator.

Reproducing the land vehicle experience in the lab

DSTO has developed a simulation environment that can represent eight vehicles in a military teaming concept. The complex simulator includes 16 networked motion platforms with additional integrated components including a battle management system, fatigue monitoring system, simulated radio network, vehicle intercom and a full video capture system.

The holistic simulation environment will assist DSTO in investigating how vehicle crews are impacted by various workloads and scenarios such as convoy teaming, sleep deprivation and the use of in-vehicle information and communications technologies.

Improved hand grenades

DSTO weapons and pyrotechnic experts have been investigating improvements to Army's hand grenades.

The three-year research program has delivered an extensively redesigned F1 grenade, yielding twice the lethal energy of the original; a new heavy blast grenade; a new anti-structure grenade; and a new multi-component modular blast grenade concept. DSTO has also developed a new in-house capability for mixing and pressing advanced explosive materials.

The revised F1 grenade, the heavy blast grenade and the anti-structure grenade

have been fully tested and their design specifications made available for transition to Defence industry.

Improving submarine motor reliability

In collaboration with the Australian Submarine Corporation and the Directorate of Submarine Engineering, DSTO has developed an innovative repair process for replacing the armature bands of the main propulsion motor of the Collins class submarine, significantly increasing the motor's reliability.

The original armature bands, which restrain the motor's winding during operation, were found to be ageing prematurely and could potentially cause catastrophic failure of the submarine's main propulsion systems. Together with its project partners, DSTO was able to identify the root cause of the breakdown, and develop an in-house procedure for the repair.

As of 2014, the armature bands of three motors had been replaced and the knowledge and expertise acquired through the project continue to inform the management of all motors in the class.

The research was nominated for an Engineers Australia Engineering Excellence Award, South Australian division.

Surveying of beaked whales

As part of an environmental impact assessment for a series of joint maritime exercises between Australia and the United States, DSTO led a team of scientists surveying the distribution of beaked whales in the exercise area.

Most whales that get stranded during naval exercises in the northern hemisphere tend to be beaked whales. Knowledge of the areas that these whales inhabit is essential so that those locations can be avoided during operations.

Beaked whales are small and particularly elusive so are rarely seen, and therefore cannot be surveyed using conventional visual methods. The team pioneered a surveying method that used the detection of the sounds produced by the whales to build a map of their presence over the exercise area. This remains the only successful example of wide-scale surveying of beaked whales worldwide.

Naval situational awareness demonstrator

LIVE is a situational awareness demonstrator, developed by DSTO, to assist staff on naval vessels. The LIVE software has commenced its fourth Navy deployment and is being evaluated by operations room staff. In July 2014, LIVE was transitioned into an operational component of the STARDUST carry-on carry-off electronic warfare system.

DSTO is undertaking ongoing collaborative research with three US government research agencies who are seeking to integrate additional tactical data streams into LIVE and enhance its tracking performance.

New technique to repair Hornet wings

The forward spar of the outer wing of the classic F/A-18 Hornet was found to develop fatigue cracks and DSTO has designed a new technique for its repair. The DSTO method reduces repair time and costs, avoids additional damage during removal of the wing skins, and prevents the damage recurring.

While DSTO performed the initial repairs, it has since designed and manufactured repair kits, manufactured the initial batch of boron-epoxy patches and developed the repair procedure for the Air Force. It has also supported the training of Air Force technicians to conduct the repairs and developed standards for non-destructive inspections.

Enhanced surveillance capability

The Jindalee Operational Radar Network (JORN) is a key strategic component of the Australian surveillance system, providing wide-area and long-range air and surface surveillance of the northern and western approaches to Australia. This indigenous capability has been developed by DSTO and its partners over three decades.

DSTO enhancements to the system were implemented in May 2014, resulting in a substantial increase in performance and operability. This has included a significant increase in instantaneous surveillance coverage, the introduction of an interference mitigation suite, and improvements to detection sensitivity, target classification, airfield surveillance, and the improved tracking of manoeuvring air targets.

Recent DSTO research has been concerned with improving the system's detection and tracking performance against larger, slow moving targets such as ships on the ocean surface. This is a significantly more difficult task than detecting fast moving aircraft. To overcome the key difficulties associated with ship detection, DSTO has developed a new kind of over-the-horizon-radar called the Mode-Selective Radar. In a world first, experimental trials of the new technology have shown it to be effective in detecting and tracking surface ships.

Uncovering the benefits of virtual exercises

Large-scale collective training exercises provide valuable learning opportunities for Air Force personnel but occur infrequently due to high costs.

Networked simulators have the potential to provide similar training experiences more affordably and more regularly. However, the use of simulators to deliver effective training requires an understanding of the knowledge and skills that must be acquired, the strengths and weaknesses of the particular systems being used and the nature of the human performance benefits of different kinds of training.

Exercise Black Skies 14, held in mid-2014, was the latest in a series of research exercises conducted by DSTO to help the Air Force understand how to make the most effective and efficient use of networked simulators for collective training.

As part of the exercise, DSTO developed new methods for monitoring the physiological and behavioural state of teams of operators automatically, non-invasively and in near real-time.

The use of improved review tools greatly enhanced the learning experience for participants by integrating replays of mission-critical events from multiple perspectives, incorporating radio communications, objective metrics and instructor evaluations. DSTO also developed enhanced scenario-generating tools to reduce the workload and number of staff required to plan and manage exercises.

DSTO's expertise in the area of networked simulation has led to its distributed simulation technologies being trialled with the United States, Canada, New Zealand and the United Kingdom.

Oval shaped shield atop ANZAC ship.

Shields to reduce electromagnetic interference

In collaboration with the Rapid Prototyping Development and Evaluation Group and the Navy Communications and Information Warfare branch, DSTO conceived, designed, tested, manufactured and transitioned into service a remediation shield for the ANZAC class frigates to prevent electromagnetic interference from the satellite communications antenna impacting on the performance of the ship's electronic warfare systems. Due to the interference, the two systems could not be used concurrently.

The shield, now installed on four frigates, successfully blocks interference and allows for the simultaneous operation of wide-band satellite communications and electronic warfare systems.

Shape optimisation extends life of missile launcher

The missile launchers fitted to most of Australia's classic F/A-18 Hornet aircraft have been found to experience cracking in the guide rail. Using its shape optimisation technology, DSTO has developed a method to repair damaged components and return them to service. Repaired housings have performed well in flight tests, with no cracking detected. DSTO's work is expected to produce significant cost savings by reducing the replacement of components and improve aircraft availability.

Testing the endurance of the Hawk Lead-in Fighter

DSTO is undertaking fatigue tests on the Hawk Lead-In Fighter to establish the airframe's endurance limits. Midway through 2014, DSTO had completed 30,000 test hours of a planned 50,000 hour target and has commenced wing removal for the next inspection phase. The information obtained will be used to support the ongoing airworthiness of the aircraft.

Hawk Lead-in Fighter fatigue test.

Ensuring Defence is a **smart buyer**

DSTO provides the government with critical advice on Defence acquisitions. It participates in all stages of the acquisition process, from initial capability definition through to the selection process and introduction into service, helping to identify and mitigate risk.

In providing advice, DSTO considers the whole-of-life costs of the purchase, including sustainment and operating costs. It determines whether the acquisition and its support systems can be delivered and integrated into the Australian Defence Force within the designated time frame, and if the acquisition will provide the capability that was originally specified.

Technical risk assessments

DSTO's primary method of providing acquisition advice is through Technical Risk Assessments. The Chief Defence Scientist is required to advise the government on the technical risks for every major Defence acquisition decision.

In 2013-14, DSTO provided Technical Risk Assessments for 30 major capital projects and Technical Risk Certification for another 17.

Technical Risk Assessments ensure that decision-makers in Defence and government are fully aware of the risks associated with a project. This helps inform Defence's risk management strategies.

Advising on Australia's new air combat capability

DSTO is providing critical scientific and technical support to the acquisition of the Joint Strike Fighter (JSF). Specifically, DSTO has conducted extensive research into the new technologies being developed, assessing their impact on the JSF and how the aircraft will fit into the capability mix of the ADF.

In a recent assessment, DSTO advised that while the development of the JSF was progressing in line with expectations for a developing capability, the technical challenges relating to computer processor performance, helmet maturity and aircraft reprogramming required additional work to reduce risk.

In 2014, based on a submission from Defence which included DSTO's assessment, the government approved the acquisition of 58 additional aircraft to meet Australia's air combat capability requirement. This brings to 72 the total number of F-35 aircraft to be acquired by Australia.

Assessing the Hawkei vehicle

DSTO has undertaken a Technical Risk Assessment for the Thales Hawkei vehicle, which is under consideration as the Army's new lightweight Protected Mobility Vehicle. DSTO's assessment considered the maturity of the Hawkei vehicle against the Army's needs, concluding that more time was required for development in key areas such as protection and reliability. Based on this advice, Defence decided to allow time for additional development to proceed and for key tests to be completed before committing to the acquisition.

Hawkei prototype on trial in Queensland.

Iron Bird model of Joint Strike Fighter

Along with its industry partners, DSTO has developed a full-scale model of the JSF to investigate the effects of electromagnetic interference such as radar and lightning on the aircraft. DSTO's research in this area provides the Australian Government with insight into potential technical risks as it proceeds through the acquisition process, and will be used to enhance the aircraft's capability.

The completed model was formally commissioned on 3 July 2014 by Senator David Johnston.

Advising on the benefits of HUMS for G-wagon fleet

The G-Wagon vehicle is used by Defence for tactical training, supporting disaster relief and securing Australia's coastline. As a new fleet of G-wagon vehicles is rolled out to the Army and Air Force, DSTO is providing Defence with advice on the benefits of using a Health and Usage Monitoring System (HUMS) for the maintenance of the fleet.

Identifying capabilities for the future frigates

Working with stakeholders from Navy, Capability Development Group, the Defence Intelligence Organisation and the Defence Materiel Organisation, DSTO undertook high-level operational analysis to assess what capabilities the Navy's future frigates will require to ensure Australia's maritime forces remain effective across the range of missions specified under the Defence Strategic Guidance.

Specifying requirements for patrol boats

DSTO has been involved in determining the requirements for the patrol boats that will replace the current Armidale fleet. Modelling and analysis were undertaken to establish required speed profiles, manning levels, and fleet availability. DSTO has also provided advice and support to develop functional and performance specifications.

An exercise MU90 torpedo firing in preparation for the live 'war shot'.

Putting the lightweight torpedo to the test

Before the new MU90 lightweight torpedo could be accepted into service, DSTO played a critical role in demonstrating its performance capability.

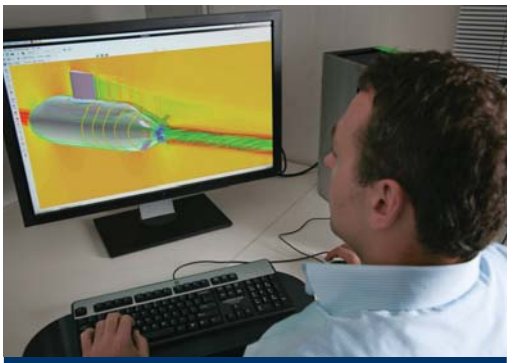
In the world's first live-firing trial of this weapon, DSTO coordinated the design and build of an innovative acoustic target for the test. The DSTO trials team oversaw the deployment of the target and worked in close concert with Navy throughout the live firing trial. The torpedo successfully detected, engaged and destroyed the target, providing Navy with the evidence it needed to accept the torpedo into operational service.

High performance computing

During the year DSTO acquired a high performance super computer to carry out extensive modelling and simulation studies in support of the Future Submarine Program.

The super computer has reduced the time taken to run numerically intensive computational fluid dynamics models from months down to days, while allowing significantly more detailed simulations to be completed within practical timeframes.

The data collected from these studies will assist DSTO in developing an accurate and comprehensive set of requirements for the future submarine capability and provide the basis for technical advice to government aimed at reducing risk in critical areas.



Computational fluid dynamics study using the super computer.

Future-proofing Defence

As a research organisation, it is incumbent on DSTO to monitor emerging technologies or developmental domains to determine whether they present an emerging threat or offer critical defence and national security capabilities.

DSTO has identified ten key technology areas likely to provide game-changing capabilities for Defence in the future. These areas include:

- Autonomous systems
- Cyber warfare
- Future undersea warfare
- Intelligence, surveillance and reconnaissance
- Signature management
- Bioterrorism preparedness
- Future electronic warfare
- Hypersonics
- Materials and energy
- Space systems

By investing in strategic research in these select technology areas, DSTO is helping position Defence and national security agencies to exploit future opportunities and prevent strategic surprises.

Anti-missile decoy flares deployed from a Seahawk helicopter.

Enhancing aircraft self-protection

As part of the Australian Airborne Countermeasures team, DSTO scientists have worked with representatives from Air Force, Navy aviation, Army aviation, the Defence Materiel Organisation and the Defence Intelligence Organisation, to develop a systematic program for the development and validation of countermeasures that protect military aircraft from missile attacks. All 13 Defence combat and combat support aircraft types have now been fitted with airborne self-protection countermeasures.

The team's work has helped to increase the survivability of Australian aircraft, enhanced the protection of Australian personnel and greatly increased the scope of operations in which Australia is able to participate.

In addition, the team has created a workforce and capital assets that will serve Defence for many years to come.

For their efforts, the team was awarded the Prime Minister's Award for Excellence in Public Sector Management in December 2013.

Hypersonic flight

Hypersonics could be a game-changing technology for Defence capability. DSTO is involved in two hyperonics programs - HIFiRE, a collaborative program with the United States Air Force Research Laboratory, and SCRAMSPACE, a University of Queensland-led project.

DSTO's research is focused on developing air-breathing hypersonic propulsion, and designing and manufacturing the flight test vehicles to collect the data for up to nine flight tests.

In 2013, a hypersonic test flight was conducted from a site above the Arctic Circle in Norway. While the test vehicle did not achieve hypersonic flight, this experimental trial provided valuable lessons that will contribute to the growing body of knowledge surrounding this exciting technology.

Electronics engineer Donald Cook working on a back-to-back scramjet free-flyer for HIFiRE 7.

Enterprise integrated ISR architectures

Defence's vision for intelligence, surveillance and reconnaissance (ISR) is a future where sensors, systems and operators will be linked together within a common network, forming an 'ISR Enterprise' in which ISR information can be more easily discovered and shared.

To that end DSTO has developed an artificial environment in which technologies can be integrated and developed. Known as ELIIXAR (Evolutionary Layered ISR Integration eXemplar ARchitecture), it provides a unique capability to explore integrated ISR concepts and determine their impact on Defence capability. The goal is to link the ELIIXAR environment to similar frameworks overseas so that Defence can remain interoperable with coalition forces into the future.

Next-generation electronic intelligence

DSTO is continuing to develop next-generation tools, techniques, software and hardware to capture and make sense of electronic intelligence.

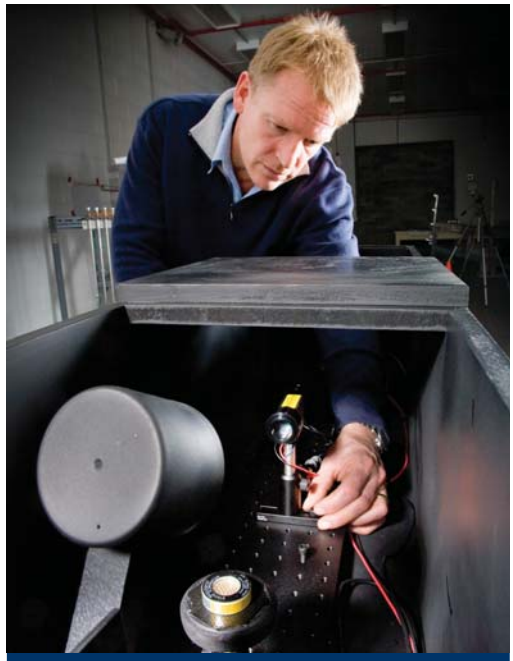
Electronic intelligence is information derived from signals that do not contain text or speech, and the ability to capture and decipher them is critical.

DSTO has developed an electronic intelligence analysis suite, and with the help of its Defence and industry partners, has deployed processing cores across the entire Defence organisation.

DSTO is also providing technical advice for the acquisition of electronic surveillance systems for Defence platforms. A variant of the first operational surveillance system to be deployed in Australia was installed and commissioned at DSTO Edinburgh, and will be used to develop capability to counter emerging maritime threats.

Advanced radiation detection equipment

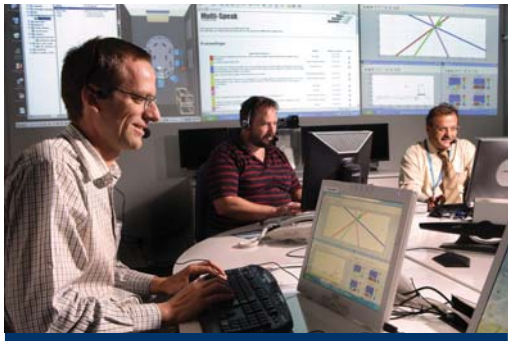
In support of Defence's ongoing efforts to maintain a technological edge against weapons of mass destruction, DSTO has developed a range of gamma imager prototypes, which can detect radiation from radiological and nuclear materials.



Scientist Michael Roberts working on an air fluorescence detection system.

The DSTO devices can accurately determine the source location, type and morphology of the material, while minimising the exposure of personnel to radiation or other hazards associated with the source.

The most recent prototype has been ruggedised and is sufficiently developed to be used in demonstrations and field trials.



Blended interactive collaboration.

Blended interactive spaces

In partnership with CSIRO and National Information and Communications Technology Australia (NICTA), DSTO has provided Defence with a significantly enhanced ability to conduct collaborative meetings involving dispersed participants.

Through the use of engaging high-quality video conferencing and shared interactive surfaces, the Blended Interactive Space provides a seamless co-location experience for users.

Visualising structural stresses

DSTO has developed a highly affordable, rugged, compact and portable means of imaging stress in dynamically loaded structures. Known as Microbolometer Thermoelastic Evaluation or MiTE, the software is being used extensively for structural integrity activities at DSTO and is available as freeware to registered users on the DSTO website.

An eye to the future

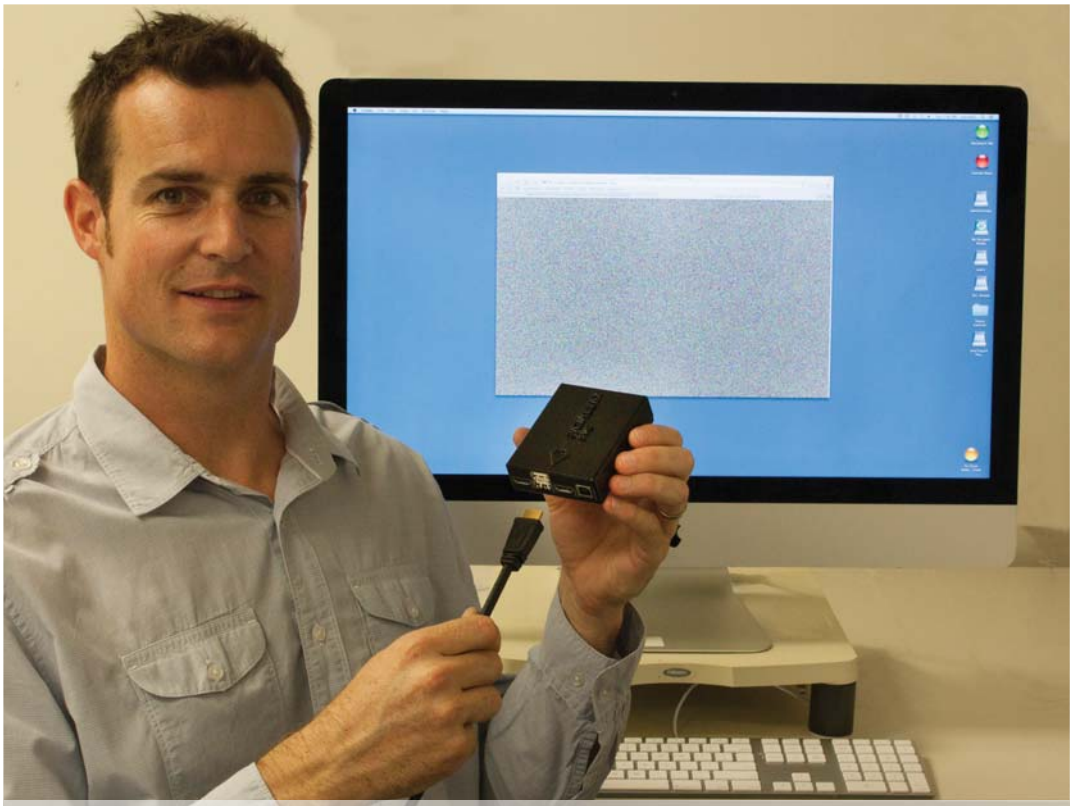
DSTO completed a foresighting study, *Forward 2035*, to examine emerging socio-economic trends and their implications for future Defence capability. The findings of this study will provide critical guidance to Defence in producing the next Defence White Paper.

Synthetic biology – living biosensors

DSTO is undertaking collaborative research to develop electrically integrated microbial biosensors, using synthetic biology. The aim is to create a new platform technology that expands the ability to sense explosives and biological warfare agents. This capability will help to protect the ecology, agriculture and health of terrestrial, maritime and agricultural areas at risk from economic and environmental damage.

The program will break new ground if it can integrate bacteria into an electrical device and then use the bacteria to sense specific compounds in the environment. Past work has used visible changes but current effort is directly integrating the electric bacteria with the electronic sensing device.

DSTO is collaborating with La Trobe University, the Macquarie University, University of Technology Sydney and the Garvan Institute of Medical Research on this project whichis also linked to DSTO's international partners - the US Navy and the US Air Force Research Laboratory.



Mark Beaumont demonstrates the Digital Video Guard.

Digital Video Guard

DSTO has developed a unique computer security device that provides protection against cyber attacks.

The Digital Video Guard (DVG) is inserted between a host computer and its display, and allows the contents of a known video signal to be trusted.

If the display is decrypted and rendered successfully, rather than being presented as random pixel data, then the integrity of the data is assured.

The DVG has wide applicability for secure content delivery in areas such as internet banking, and in the management of sensitive information such as taxation data, welfare data and medical data.

In 2014, the DVG won the 'Research and Development' category in the South Australian iAwards.

From the *Forward 2035* report

The four major implications for Australian defence and its science and technology, framed from a people-centric perspective, are as follows:

- **Mastering Complexity:** population growth and geography are leading to greater complexity in urban centres where competition for resources will increase along with growing congestion of supply chains. Civilian and military infrastructure will become highly interconnected and interdependent, whilst military systems are already so complex they are pushing boundaries of manageability.

- **Trust in Technology:** forecast demographics coupled with technology developments in automation are driving change in the nature of work where we will increasingly have to balance the employment of humans and 'intelligent' machines. Learning to trust machines whilst also addressing cultural, legal and ethical issues will be necessary.

- **Smart Power:** economic development in the Asian region is presenting many business and commercial opportunities for Australia beyond the resource sectors. The growing investment in R&D across Asia presents an opportunity to enhance diplomatic and cultural ties through the shared language of science, with Australia already having a strong R&D base with linkages to US and Europe.

- **Innovation Enterprise:** emerging social structures and expectations within the region are driving corporations to change their business models to meet new demands. The new 'sharing economy' business models, if leveraged by Defence, will ensure that Defence can source material and manage its supply and logistics countering some of the concerns with the protection of complex and congested supply chains.

Enhancing national security

DSTO coordinates the whole-of-government science and technology research program in support of Australia's national security.

Together with other government agencies, DSTO provides strategic analysis of national security priorities and resourcing, fosters international and national security research collaborations and explores opportunities to integrate counter-terrorism technologies to benefit Defence and civilian agencies.

In 2014, DSTO developed a National Security Science & Technology Policy Statement and a supporting Program to achieve a coordinated, whole-of-government approach to Australia's national security science and technology priorities. The policy and program are intended to provide the mechanism for industry and academia to engage as partners with DSTO to deliver the science and technology required to meet the capability for operational challenges facing national security agencies.

SmartGate in use at an Australian airport.

SmartGate for automated facial recognition

DSTO has contributed to the successful implementation of SmartGate, an automated facial recognition border clearance system that allows for the processing of an additional 2 million travellers per year transiting in and out of Australian ports.

SmartGate was developed by the Australian Customs and Border Protection Service in 2001 as a prototype.

DSTO successfully developed a framework for the evaluation of SmartGate, carried out both human and technical assessments in operational trials, and provided independent expert advice and recommendations for its deployment and improvement.

SmartGate was shown to significantly reduce traveller processing times and increase traveller satisfaction. It has now been rolled out to all Australian and New Zealand international airports and DSTO continues to provide support to ensure that it remains a world-leading border security capability for both arrivals and departures.

Improving the conduct of national security exercises

In response to a government audit which identified a need to improve how national security exercises are tested and evaluated, DSTO developed a new methodology that guides the design and conduct of exercises across Australia.

DSTO's work involved designing evaluation units to be included in national training packages, producing a chapter on evaluation methodology for the Australian Emergency Management Handbook, and developing and evaluating the use of the "Red Teaming" methodology for national security.

DSTO used its new methodology to develop a report on security issues for the G20 summit in 2014. That report informed the communications and media strategies for the summit, as well as major sporting events.

Cyber 2020 Vision: DSTO's cyber science and technology plan

Cyber security is vital to the integrity of Australia's commercial, government, business and military systems. *The Cyber 2020 Vision* outlines DSTO's strategy to strengthen Australia's cyber security capabilities. The plan outlines how DSTO will address the emerging relationship between cyber and electronic warfare, signals intelligence and communications. It looks at ways to ensure that DSTO's science and technology is relevant, resilient and responsive, and it highlights how DSTO will engage with the national community to foster a cohesive, integrated national cyber science and technology capability.

The DSTO Future Cyber Security Landscape: A Perspective on the Future is a companion paper to *Cyber 2020 Vision*. It provides the Australian context to strategic investment in cyber security capabilities and cyber security science and technology.

GPS monitoring station

A network of monitoring stations around the world maintains the accuracy of the Global Positioning System (GPS). DSTO runs the GPS monitoring station at Edinburgh, South Australia on behalf of the United States' National Geospatial-Intelligence Agency. Hosting the facility at DSTO Edinburgh provides DSTO with access to the United States' GPS program which contributes to the development of the next-generation satellite navigation capability for the military.

In 2014, the Edinburgh GPS station underwent a major infrastructure upgrade, aligning it with the modernised United States' system.

A first responder's chemical companion

In collaboration with the United States, DSTO is supporting the development of a software package designed to provide decision-making support to first responders when managing exposures to hazardous materials.

Known as the "Chemical Companion", the tool is available to approved members of the military, law enforcement, and fire departments. It continues to be improved and refined.

Support to the **civilian sector**

DSTO is frequently called upon by civilian agencies to lend its unique expertise in crisis situations or to provide humanitarian assistance. During the year DSTO was involved in the international search for Malaysia Airlines flight MH370 which disappeared without a trace in March 2014. DSTO is also assisting the Australian Federal Police with its investigations into the tragic loss of Malaysia Airlines aircraft MH17 over Ukraine.

In June 2014 DSTO successfully completed a mission to explore and secure the wreck of the scuttled Australian World War I submarine as part of its contribution to the Silent ANZAC project.

Trajectories generated from the likely distribution of the MH370 flight path.

Contributing to the search for Malaysia Airlines aircraft

DSTO is one of a number of agencies around the world contributing to the search for Malaysia Airlines aircraft MH370. DSTO's collective knowledge and experience in sonar technologies, satellite communications, target tracking and data fusion have proved to be invaluable in the search effort.

The expertise of DSTO scientists from three divisions was critical in establishing that signals detected from two acoustic searches were not related to the missing aircraft. Moreover, as part of the international working group assembled by the Australian Transport Safety Bureau, DSTO's ongoing analysis of the satellite communications data has been pivotal in continuing to refine the search zone.

The sparse and uncertain nature of the satellite data has presented many challenges for the team, requiring the continued development and refinement of mathematical models to determine plausible flight paths. Such is the complexity of the analysis, even the effect of the Earth's shadow on the satellite had to be taken into account.

DSTO continues to work with the Australian Transport Safety Bureau and the international working group to better understand the variability of the satellite data, research the trajectory prediction problem and more accurately refine the search area for the missing aircraft.

"We have been very impressed with the work of the DSTO team during what I know were very trying times for your organisation. The speed with which you all fitted into an ongoing arrangement, the technical ability and responsiveness of the DSTO team and the collaborative spirit of the whole exercise are a fine example of cooperation towards a great result."

Martin Dolan | Chief Commissioner, Australian Transport Safety Bureau.

Conning tower hatch.

Inserting the camera through the hatch.

DSTO assists Silent ANZAC project

In June 2014 a team of DSTO scientists returned from Turkey where they successfully explored the interior of the WWI submarine *AE2* that was scuttled during the Gallipoli campaign in 1915 and has been lying at the bottom of the Sea of Marmara for 99 years.

The DSTO team, led by Dr Roger Neill, was assisting in the Silent ANZAC project, a joint initiative of the Australian and Turkish governments, involving the *AE2* Commemorative Foundation and Submarine Institute of Australia.

Back in 2007 the DSTO team had visited the site of the wreck for a preliminary survey of the submarine. It involved years of careful preparation which included creating a 3-D model of the submarine's interior and exterior and a drop camera system that would allow an internal examination of the control room.

The findings from that mission resulted in options for the future preservation of the historic relic. A second expedition was called for to explore the interior of the boat. It was acknowledged that the exploration be conducted in accordance with accepted marine archaeological practices.

For the 2014 expedition the DSTO team designed, developed and evaluated novel lighting and camera systems as well as refining operational concepts for the remotely operated vehicle. All systems were checked using a specially constructed submarine replica at Corio Quay in Geelong.

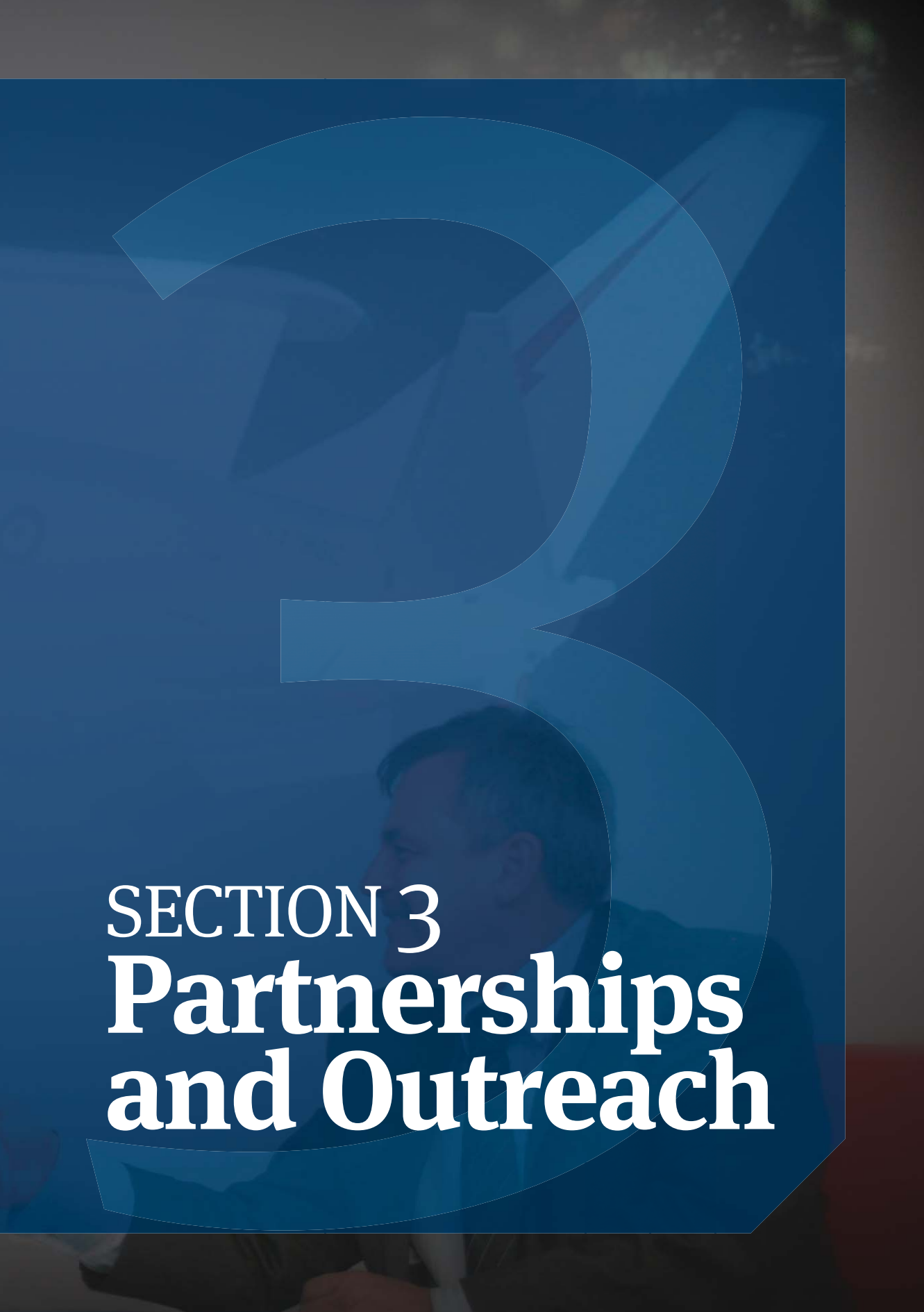
During the June expedition the team inserted a high-definition camera and lighting system through a 100 mm opening formed by the partially-ajar main hatch of the submarine wreck. Having confirmed the inside of the submarine was relatively clear, the hatch was opened allowing a remotely operated vehicle to be inserted. Over the next three days a detailed survey was undertaken of the many internal spaces in the *AE2*.

According to project leader and chair of the *AE2* Commemorative Foundation, Rear Admiral Peter Briggs AO CSC (Ret'd), "The submarine interior is in amazingly good condition, original paint, signalman's sand shoes (plimsolls) still stowed in the flag locker in the conning tower along with the flags and what we believe was the battle ensign used by Lieutenant Commander, Henry 'Dacre' Stoker, DSO, 99 years ago."

Dr Neill said the images will teach us a great deal about life on board early WWI submarines and about the *AE2*'s final moments on 30 April 1915 when she was attacked and had to be scuttled.

Following the expedition the site has been secured and a cathodic protection system installed around the wreck to control corrosion, along with a marker buoy to protect it from shipping traffic, anchors and fishing nets.

The Turkish Government will ensure ongoing maintenance of the buoy laid over *AE2* for protection against further damage, acknowledging the importance of preserving this shared piece of Turkish and Australian maritime military heritage.



SECTION 3
Partnerships and Outreach

Enhancing outcomes through **collaboration and engagement**

DSTO recognises that the best outcomes are achieved through strong and enduring partnerships with industry, academia and government. Through its partnerships, DSTO accesses and leverages world-leading science, technology, knowledge and innovation, enabling it to provide quality advice and innovative solutions for Australia's defence and national security.

As evidence of its commitment to engagement and collaboration, DSTO has created the Partnerships and Outreach Group, which is responsible for coordinating and developing DSTO's interactions with industry, academia, overseas agencies and other Australian Government agencies. In addition, DSTO's Business and Commercialisation Office was reviewed and reorganised as the Technology Partnerships Office, reflecting a renewed emphasis on collaboration and partnerships.

Over the past two years, DSTO has significantly enhanced its engagement with industry and academia. It executed eight new strategic alliances with defence companies, and established Memoranda of Understanding with three government science agencies. It also introduced the Defence Science Partnerships program to facilitate closer engagement with universities.

Outside of its research activities, DSTO has an important role to play in helping Australia develop a national science, technology, engineering and mathematics (STEM) capability to ensure that the long term human resource needs of Defence can be met. DSTO is working cooperatively across the primary, secondary and tertiary education sectors to promote the study of STEM. It is also playing an active role in promoting the benefits of defence science and technology to the broader community.

IBM representatives signing DSTO strategic alliance.

Mark Bateup.

Partnering with industry

Industry collaboration is core to DSTO's new corporate strategy. In 2013-14, strategic alliances were established with three companies, making a total of eight industry partners, including the Australian Submarine Corporation, BAE Systems, Boeing, IBM, Lockheed Martin, Northrop Grumman, SAAB Australia and Thales.

A Memorandum of Understanding was also negotiated with iconic Australian company, Hills, under which DSTO will participate in Hills' Innovation Centres, an initiative to support and fund new and innovative next-generation technologies.

In addition to undertaking collaborative research with its industry partners, DSTO

introduced the Industry Placement program which gives Defence scientists and engineers the opportunity to spend time in industry for up to two years before returning to DSTO.

The program is designed to build stronger linkages between DSTO and industry, provide industry with access to research capability and develop within DSTO a better understanding and appreciation of the industry environment.

Hypersonics researcher Dr Mark Bateup was the first DSTO staff member selected under the scheme and placed with Australian systems engineering company Aerospace Concepts.

Great things have been achieved by DSTO and Thales' combined effort

I believe the partnership of industry and Defence is critical to the long-term security of Australia. The ability to build capability advantage through shared knowledge is a vital asset that Australia needs to exploit to ensure its large domestic and regional responsibilities can be met with a relatively small population.

Our knowledge resources need to be employed in the most effective way. With this in mind I see the work of DSTO with industry and its current strategy of fostering closer links with industry in shared research and delivery of capability outcomes as an extremely positive sign that we are heading in the right direction.

In the past years great things have been achieved by DSTO and Thales' combined effort. Towed sonar arrays for our large conventional submarines developed here in Australia have brought advantage to Australia's unique operations. Growing from this we have also seen a next-generation of towed arrays of much smaller diameter developed in joint DSTO and Thales research into fibre optic technology. This has not only delivered Australia significant capability advantage in maritime operations but also has delivered important commercial spin-off exports in the marine oil and gas markets.

In the field of protected vehicles DSTO and Thales working with DMTC have developed world-leading blast modelling and testing. The high level of correlation between our design methods and test outcomes have delivered improved protection for our troops on operations in Afghanistan, with Bushmaster directly saving lives, and have made it possible to generate new designs like Hawkei to meet the ADF's future needs.

Combining the knowledge and expertise of DSTO and industry is, I believe, an essential ingredient to Australia's evolution as an advanced technology-leading nation and is providing the future security all Australians have come to expect.

Chris Jenkins | CEO, Thales Australia

Partnering with universities

To strengthen its collaboration with universities across Australia, DSTO has established the Defence Science Partnerships framework.

This new collaboration framework provides a uniform model under which universities can engage with Defence. It establishes consistent terms and conditions, a common costing structure and standard intellectual property provisions.

The Defence Science Partnerships Program was launched at the University of Canberra at the Universities Australia's annual meeting of the Deputy Vice Chancellors-Research. The new partnerships model has been enthusiastically welcomed by Australian universities.

At the time of preparing this Annual Review, 22 universities had signed up to the program.

They include:

- Australian National University
- Charles Darwin University
- Curtin University
- Deakin University
- Flinders University
- LaTrobe University
- Macquarie University
- Monash University
- Queensland University of Technology
- RMIT University
- Swinburne University
- University of Adelaide
- University of Canberra
- University of Melbourne
- University of New South Wales
- University of Queensland
- University of South Australia
- University of Sydney
- University of Tasmania
- University of Technology Sydney
- University of Western Australia
- Victoria University

DSTO also has existing agreements in place with a number of Australian universities in niche science and technology areas.

DSTO and university representatives at the launch of the Defence Science Partnerships program.

Closer engagement with government agencies

DSTO seeks to enhance its science and technology outcomes by collaborating with other government agencies, both domestically and internationally.

This interaction not only ensures optimal use of Australia's public research and development resources, but also helps to broaden Australia's science and technology capabilities for both defence and civilian purposes.

During the past two years DSTO has established strategic alliances with three publicly funded research agencies - CSIRO, the Bureau of Meteorology and the Australian Nuclear Science and Technology Organisation. It also provided support to Customs and Border Security for the implementation of an enhanced border clearance system and the Australian Transport Safety Board in the search for Malaysia Airlines aircraft MH370.

As the lead agency for the whole-of-government national security research program, DSTO has worked closely with Australia's national security agencies to develop a National Security Science and Technology Policy Statement and a supporting program.

Internationally, Australia's cooperation with its allies and regional partners is an important element of the country's defence science and technology capability. By undertaking collaborative research with allied countries, Australia, through DSTO, is able to access overseas capabilities that would not otherwise be available to the Australian Defence Force.

Members of the Weapons Group from the international Technical Cooperation Program (TTCP) received an Aussie welcome when they visited DSTO for talks on collaborative research.

A high-level delegation from the US Department of Homeland Security visited DSTO and Assistant Minister for Defence Stuart Robert, to discuss collaboration on science and technology in support of national security.

In 2013-14, DSTO's main focus internationally was on Asia where it established a permanent Tokyo office to promote greater collaboration between DSTO and its counterpart, the Technical Research & Development Institute. DSTO welcomed the 2014 signing of the bilateral agreement between Australia and Japan, a historic first, which allows for the transfer of Defence equipment and technology. This has laid the groundwork for DSTO to start a collaborative research program with Japan on hydrodynamics. Cooperation with the Republic of Korea continued in the area of chemical and biological defence. The year also saw increased interaction with Singapore through new collaborative projects.

Under The Technical Cooperation Program (TTCP), DSTO and its traditional five-eyes partners sharpened their focus on implementing a program of enhanced mutual reliance to share national capabilities, skills and facilities for the benefit of all.

Fulbright Distinguished Chair

DSTO has partnered with the Australian-American Fulbright Commission to establish a Fulbright Distinguished Chair in Advanced Science and Technology which enables a senior US researcher to work with DSTO in Australia for up to 6 months on a priority research project.

The first DSTO Fulbright Distinguished Chair, Professor Murray Loew from George Washington University, was selected during the year. He spent five months with a DSTO team collaborating on image and data fusion, and the tracking of moving objects, based on his expertise in image processing and analysis for medical and military applications. Professor Loew will complete a research paper on his collaboration.

Professor Murray Loew.

Professor Gibson of UK Ministry of Defence congratulates DSTO team on joint UK missile test trial at DSTO.

Joint simulation trial with the UK

DSTO participated in a month-long trial to assess the practicalities of sharing research facilities between DSTO and the Defence Science and Technology Laboratory (Dstl) in the UK.

The trial involved integrating and testing a UK missile asset in DSTO's Missile Simulation Centre and Radar Target Generator System in South Australia.

The trial is regarded as a landmark, successfully cross-validating the UK's weapon evaluation methodology with the techniques used by DSTO.

The DSTO and Dstl teams were presented with a commendation by the Chief Scientific Adviser to the UK Ministry of Defence, Professor Vernon Gibson for their exceptional contribution to defence science and technology. The successful trial has shown the benefits of collaboration and mutual reliance for significant defence science and technology capabilities.

Collaborating to enhance innovation

In July 2014, DSTO and the Defence Capability Development Group hosted the inaugral Defence Innovation Forum. The intent of the forum was to discuss how Defence and its industry and academic research partners can work together more effectively to enhance the delivery of innovative capabilities for the Australian Defence Force.

The forum brought together over 250 representatives from Defence, academia, government research organisations and industry, and marked an important first step in an ongoing dialogue to improve innovation in Defence.

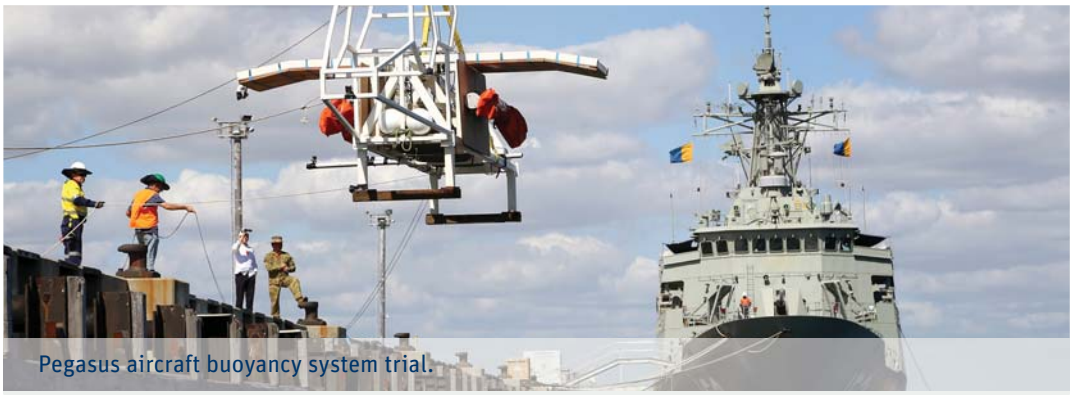
Dr Warren Harch addresses Defence Innovation Forum.

Funding Defence innovation

The Defence Innovation Realisation Fund (DIRF) was established in 2013-14 to support the development of innovative technologies from initial research or technology demonstration to a mature capability ready for Defence acquisition.

The fund is financed under the Defence Capability Plan and is administered by DSTO on behalf of the Capability Development Group in Defence. It is designed to help fill gaps between existing innovation programs, acting as a clearing house for the various Defence programs such as the Rapid Prototyping Development and Evaluation Program, the Capability and Technology Demonstrator Program, the Defence Materials Technology Centre, Diggerworks and the Priority Industry Capability Innovation Program.

Innovative outputs from any of these programs can be considered for DIRF funding. During the year five proposals were approved with a combined funding support of $15 million.



Pegasus aircraft buoyancy system trial.

Projects funded by the Defence Innovation Realisation Fund

Broadband Spherion Advanced Processing System (Thales Australia Ltd.) Developed under the Capability and Technology Demonstrator Program, this system is an upgrade of the existing hull-mounted sonar on the ANZAC Class Frigates.

Fibre Optic Towed Array (Thales Australia Ltd.) Based on fibre laser sensor technology, the Fibre Optic Towed Array is less than 20 mm in diameter, more flexible, lighter and subject to less drag. As an underwater surveillance array using micro-sized lasers, it can detect sounds with extreme sensitivity.

Standoff Handheld Person-Borne Improvised Explosive Device Detection System (Rapid Prototyping, Development and Evaluation Program) This system combines optical and electronic detection technologies to provide a standoff IED detection capability not currently available. It significantly improves the individual safety of soldiers involved in IED detection operations.

Advanced Nano-structured Fabrics for Low-burden Personal Protection (Defence Materials Technology Centre) This proposal involves further developing a technology that could provide lower-weight personal protection against chemical and biological threats, including aerosols.

Pegasus Aircraft Buoyancy System (One Atmosphere) This is a post-crash recovery system that re-floats a helicopter ditched at sea and allows the crew to escape safely.

Promoting science, technology, engineering and mathematics

Australia, like many countries around the world, suffers from a shortage of workers with skills in science, technology, engineering and maths (STEM). As a means of addressing this critical skills gap, and to enhance the future pool of graduates that will feed into Australia's workforce, DSTO encourages its staff members to participate in activities that promote STEM.

In 2013-14, a number of DSTO employees participated in the government's "Scientists and Mathematicians in Schools" program under which working scientists volunteer their time to primary and secondary schools across Australia to inspire and engage students, encouraging them to study STEM subjects.

In the tertiary sector, under the newly established Defence Science Partnerships framework, DSTO is working with universities to introduce a range of scholarships and cadetships to encourage students to pursue STEM qualifications.

Enhancing diversity

A key element of DSTO's strategic plan is to improve the organisation's gender and indigenous diversity.

To address DSTO's disproportionately low number of women scientists and engineers, DSTO has established undergraduate scholarships for female students enrolled in relevant degrees. Currently, thirteen scholarships, valued at $10,000 per year, have been established at the Australian National University, the University of New South Wales and the University of Adelaide. Further scholarships are planned for other universities around the country.

DSTO also appointed its first Manager of Indigenous Engagement. A key focus of this role is to ensure a healthy representation of indigenous staff within the DSTO workforce. DSTO will be looking at a program of scholarships and cadetships as part of its indigenous employment strategy.

ANU recipients of the DSTO women's undergraduate scholarship – Joyce Mau, Molly Thomas and Katrina Kelleher.

DSTO Indigenous Engagement Manager Rebecca Halliday.

Aerospace researcher Jennifer Palmer talks to visiting students.

Reaching out to the wider community

DSTO has a corporate responsibility to engage with the Australian community to promote the benefits of defence science and technology and demonstrate the value of its research to the taxpayer. With the increased emphasis on partnerships and outreach activities, a communication strategy has been developed, designed to raise the organisation's profile and enhance its reputation.

Part of this strategy has been the increasing use of digital channels. The public website was redeveloped with multi-media content and a DSTO 'app' in both Apple and Android versions was introduced to highlight the organisation's achievements to a wider audience.

Aspects of DSTO's scientific work as well as trials of technology demonstrators and initiatives such as the female undergraduate scholarships have featured widely in the print and electronic media. The ABC science program *Catalyst* broadcast episodes on environmental testing of camouflage, hydrodynamics research and aerospace simulation. External engagement was also driven by an extensive speaking program by the Chief Defence Scientist. Under the auspices of the Warren Centre for Advanced Engineering he delivered an Australia-wide Lecture Series on Innovation, a highlight of his packed speaking commitment for the year. DSTO continued to participate in high-profile events such as Pacific 2013 maritime exposition and initiated other events, such as the Defence Innovation Forum, to bolster its engagement with industry, academia and Defence.

Internally, the communication effort was directed at creating online tools and new web platforms to assist with staff consultation and feedback, contributing to the successful management of organisational change including the DSTO restructure, the Insight Survey of staff attitudes and Strategic Plan initiatives.

Leadership communication was enhanced with the introduction of the Chief Defence Scientist's electronic newsletter *CDS E-News* and the regular *Conversation with CDS* in a Q&A format, which is streamed live to all DSTO sites.

The monthly internal staff magazine *Connections* was converted to a digital product, saving printing costs and enabling multi-media content to be added.

The expanded use of online tools has been critical in engaging and communicating with stakeholders, clients and staff more quickly, efficiently and cost-effectively.

ABC *Catalyst* science program on air simulations.

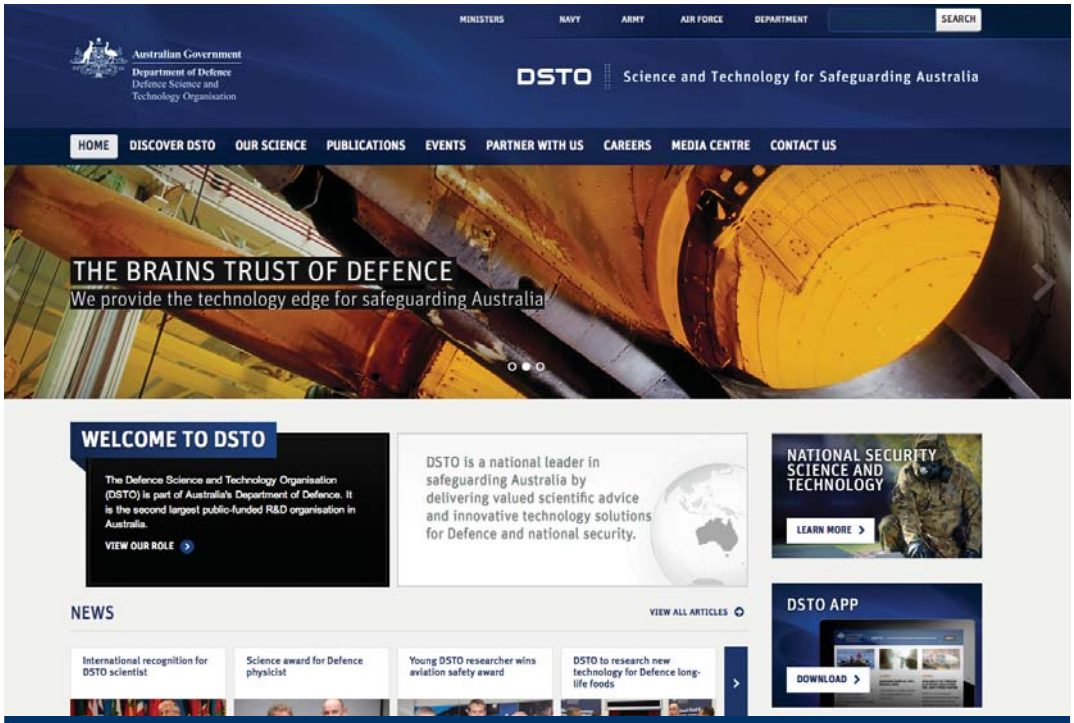
TV interview regarding Pegasus trial.

ABC *Catalyst* science program on environmental testing of military uniforms.

Science and Technology publications

DSTO records its research and reports its findings to its clients and external stakeholders in the DSTO report series. Where appropriate, DSTO authors publish their work in peer-reviewed journals or conference proceedings. This sharing of work and results contributes to the body of knowledge in a range of science and technology areas. In 2013-14 DSTO authors published or delivered 221 papers externally (Appendix D) and 79 public release reports (Appendix C).

DSTO App



DSTO Website

Conversation with the Chief Defence Scientist is a regular part of leadership communication.

DSTO HQ was renamed Dr Warren Building in honour of the black box inventor and former staff member.

SECTION 4

Investing in our people, our assets, our success

Valuing our people

As a knowledge organisation DSTO recognises that its most valuable asset is its workforce, and that the professional satisfaction and wellbeing of its people are critical to the organisation continuing to deliver outstanding scientific support to Defence.

DSTO's talent management strategy is designed to nurture potential recruits and attract and retain highly skilled staff who can continue to deliver DSTO's mission.

In 2013-14, DSTO reinforced its commitment to its people by expanding its already extensive leadership development programs, establishing a mentoring program for all levels of the organisation, and implementing programs to help staff manage and cope with change. A number of initiatives in the Strategic Plan are being employed to drive cultural reform in the organisation in line with Defence's *Pathway to Change* agenda.

High achievers

Mark Pitt with the Prime Minister's award trophies.

Prime Minister's Award for Excellence in Public Sector Management

The ADF's Australian Airborne Countermeasures Team, in which DSTO was a lead player, won the Gold Award for Most Outstanding Program or Initiative in the 2013 Prime Minister's Awards for Excellence in Public Sector Management. The award was for work on aircraft self-protection measures to protect against missile threats.

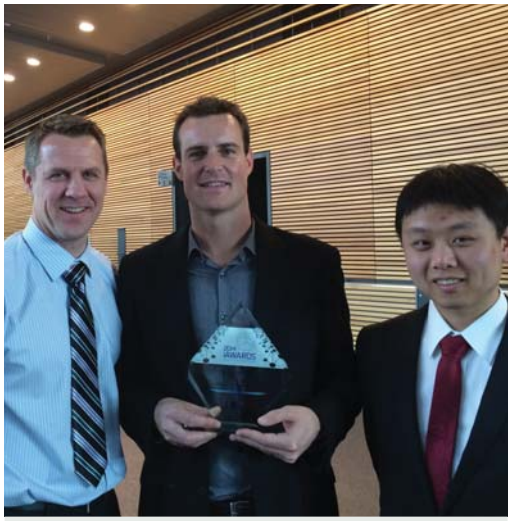
The team, which included DSTO, Air Force, Navy aviation, Army aviation, Defence Materiel Organisation and the Defence Intelligence Organisation, also won the Innovation section of the Awards.

Minister's Achievement Award

The 2013 Minister's Achievement Award was given to **Dr Andrew Amiet** for his work on improving stealth technology for Australian submarines.

Secretary of Defence Fellowship

The 2013 Secretary of Defence Fellowship was awarded to **Dr Greg Calbert** for his work on Australia's fuel security needs.



South Australian ICT Award

Mr Brad Hopkins, Mr Mark Beaumont and **Mr John Shield** (pictured), along with **Mr Chris North**, **Mr Josh Green** and **Ms Devita Pathi** won the Best Research and Development category of the South Australian iAwards for their computer security device, the Digital Video Guard.

Jaap Schijve Award

Dr Chris Wallbrink received the international Jaap Schijve Award for young aeronautical engineers in recognition of his contribution to the development of new and improved techniques for predicting fatigue and fatigue crack growth in aircraft structures. He was the first Australian ever to receive the award.

NATO Scientific Achievement Award

The NATO Scientific Achievement Award for 2013 was presented to **Dr Neville Curtis** for his contribution to the code of best practice for judgment-based operational analysis

Gold Commendation from Chief of Joint Operations

Ms Kendy Hau was awarded a Gold Commendation from the Chief of Joint Operations Lieutenant General Ash Power for her involvement in a study of the cultural compatibility of Australian and Afghan forces.

Sorby Award

Dr Stan Lynch received the Sorby Award from the International Metallographic Society to recognise lifetime achievement in the field of metallurgy.

Jim Arnold Squaredance Award

The **DSTO Leadfoot II Team** won the prestigious Jim Arnold Squaredance Award for multinational collaboration, and advancing joint operational capabilities.

INCOSE 2013 Working Group Award

The INCOSE 2013 Working Group Award was awarded to **Mr Kevin Robinson** for his leadership of the Model-Based Conceptual Design Working Group.

AC Kennett Award

Dr Anthony Trueman received the AC Kennett Award for best paper in corrosion science.

Adelaide University Innovation Champion Award for 2013

The Adelaide University Innovation Champion Award for 2013 was awarded to **DSTO** and the **Defence Systems Innovation Centre** for their joint work on establishing a Systems Execution Modelling lab for the evaluation of submarine combat systems.

2013 South Australian Science Excellence Awards

In the 2013 South Australian Science Excellence Awards, **Mr Mark McKenzie** received the Early Career STEM Professional – Physical Sciences, Mathematics and Engineering award for his contribution to a capability that allows helicopter crews to be alerted to incoming small arms fire, and enables them to accurately determine the direction of the shooter.

Body of Knowledge Award

Dr Peter Ryan was awarded the Body of Knowledge Award from Simulation Australia for his paper 'Exploration of the Role of Unmanned Aerial Systems in Distributed Simulation.'

SimTecT 2013

Dr Susannah Whitney and **Dr Justin Fidock** were awarded the Best Paper prize for their study on 'Simulation-based Organisational Learning in the Australian Army' at the SimTecT 2013 conference.

Pearcey Medal

Chief Defence Scientist **Dr Alex Zelinsky** was awarded the 2013 Pearcey Medal, Australia's most prestigious Information and Communications Technology (ICT) industry award, for lifetime achievement in the ICT industry.

National Defence Innovation Award

The Pegasus buoyancy system developed under the Defence Capability & Technology Demonstrator program to recover helicopters ditched at sea won the 2013 National Defence Innovation Award.

Australian Research Council College of Experts

Dr Anne-Marie Grisogono was selected by the Australian Research Council (ARC) to join their College of Experts.

DSTO Achievement Awards 2013

Award	To	For
Science and Engineering Excellence	Mr Scott Moss	Developing a device that harvests vibration energy from mechanical structures.
Science and Engineering Excellence	Dr Don Gossink	Leadership in the development of the Vital Planning and Analysis Tool (VIPA) which assists ADF commanders in logistics planning.
Technical Excellence	Dr Lindsay Wake Mr Stefan Danek Mr Robert Hook Mr Orazio Campanale Mr Lance Kelly Mr Thomas Clayton Dr Christopher Lyons	Developing safer, carcinogen-free paint schemes for the RAAF PC-9 aircraft.
Outstanding Contribution to Defence Outcomes	Mr Brad Tobin Mr Robert Gulley	Timely, ongoing and innovative support of the Wedgetail aircraft data links functionality.
Outstanding Early Career Achievement	Ms Cathy Smith	Undertaking a large number of investigations, effectively as principal investigator.
Outstanding Early Career Achievement	Mr Mark McKenzie	Contributing to the development of a hostile fire indication capability in support of rotary wing aircraft.
Outstanding Early Career Achievement	Ms Vanessa Pickerd	Enhancing DSTO's capability to undertake vulnerability assessments of naval platforms.
Outstanding Corporate Contribution	Ms Maree Agiazis	Excellent support to Maritime Division's external engagement.
Outstanding Corporate Contribution	Dr Felicia Pradera	Outstanding support to several DSTO divisions, including support for the establishment of the international medical countermeasures consortium.
Outstanding Contribution to Collaborative Partnerships	Dr Nigel St John Mr Gary Mathys Mr Gary Simpson	A highly successful partnership with DMO and ASC to develop safe and effective repair techniques for the Collins submarine main motors.
Outstanding Communication of Science and Technology	Mr Chris Forbes-Ewan	Excellent promotion of the science of food and nutrition.

US Office of the Secretary of Defense Medal for Exceptional Public Service

The US Office of the Secretary of Defense Medal for Exceptional Public Service was awarded to Ms Joanna Kappas for her contribution to the F-35 program during a three year attachment to the Joint Strike Fighter Program Office in Washington DC.

Profile: Joanna Kappas

Joanna's hard work and dedication was recognised with the highest award of the United States Office of the Secretary of Defense to a non-US civilian officer: the Medal for Exceptional Public Service.

The citation for her award says Joanna is 'a passionate advocate for state-of-the-art prognostics and life usage management'.

Joanna was one of several staff members from DSTO to have been rotated into this team based in Arlington, Virginia. The team of six in the US office are committed to aircraft airworthiness, monitoring each Joint Strike Fighter (JSF) aircraft constantly for its health and mission readiness.

The chance to work on a major project while the aircraft's health and usage management system was being developed and first implemented in the field was a great motivator.

'Being right there while the JSF design was still happening and we could still make changes and try to point the aircraft designers in the right direction — I knew I could make a real difference,' Joanna said. 'That was exciting.'

Prognostic and health management systems use a number of sensors and data processing capabilities to monitor vital elements of an aircraft to detect and isolate faults, assess the actual condition of individual elements and enable informed decision-making about maintenance.

DSTO has pioneered the development of several aspects of these systems, particularly the development of advanced vibration diagnostics algorithms and wear debris analysis. Accurate, reliable and up-to-date information about the state of components has saved millions in maintenance budgets and down-time for scheduled servicing.

The JSF is being designed with a range of on-board sensors which will combine with a state-of-the-art off-board system to constantly feed aircraft prognostics and health management information.

Joanna says this will change the healthcare future for the aircraft into one we can more readily identify with.

'We go to the doctor when something is not right rather than just because it's scheduled,' she said.

The JSF's health management system will also enable the ordering of spare parts and services to be automated as well as facilitate data collection to give early warning of potential faults that might be common across the fleet. All this adds up to a safer and more efficient system that minimises costs.

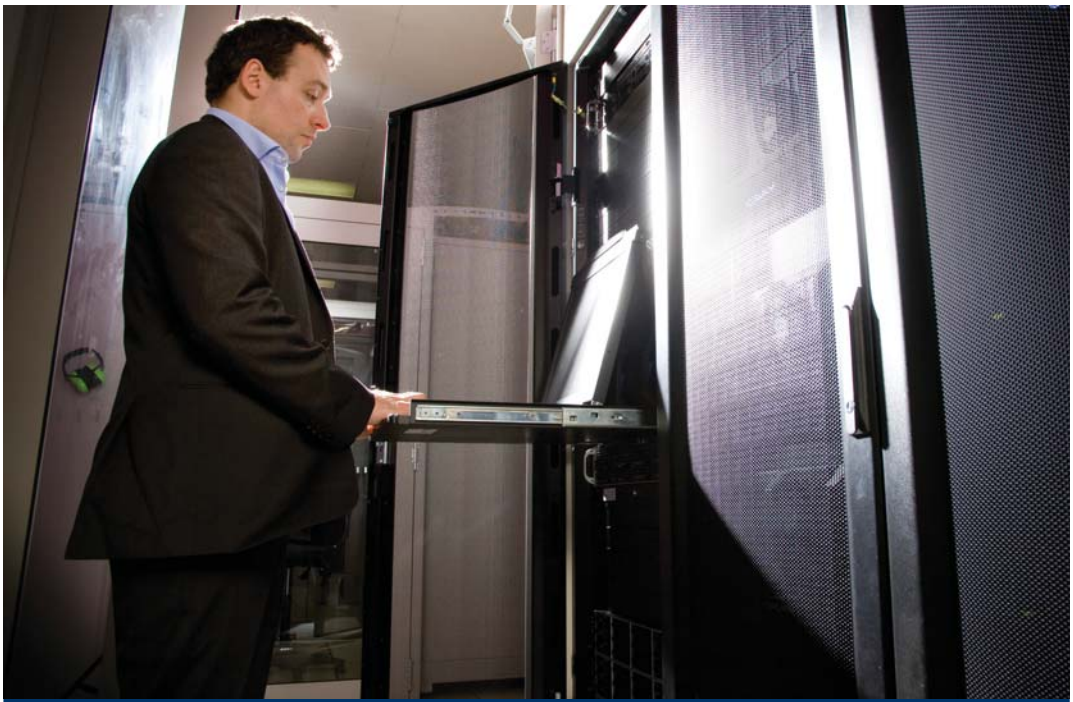
Joanna will now be looking after the health of new ADF platforms including the C27J airlifter and the Seahawk Romeo helicopter.

Investing in **organisational enablers**

DSTO understands the importance of investing in its own skills and knowledge, tools and resources to enable it to continue to deliver world-class support to Defence.

In 2013-14, DSTO made significant investments in infrastructure and organisational resources in order to enhance its research capabilities and increase organisational efficiencies. These included investments in:

- A full-scale model of the Joint Strike Fighter to investigate the effects of electromagnetic interference on the aircraft
- A high performance supercomputing capability to support the Future Submarine Program
- Wireless internet access for unclassified research activities
- Additional videoconferencing systems to enhance collaboration
- The implementation of Win7 across its research networks
- A comprehensive review of its Scientific Engineering Services function to ensure more efficient and streamlined delivery of its in-house engineering design and manufacturing services.
- OpenAthens and SearchLight for easy access to electronic content and unified searches of the DSTO library's subscribed resources from multiple and remote devices.



Daniel Norrison operating the supercomputer.

SECTION 5
Appendices

Appendix A: **Capability and Technology Demonstrator projects**

The Capability and Technology Demonstrator program is the Defence Department's flagship technology innovation program. It is not a grants program; rather it is a collaborative activity conducted under contract between Defence and industry or other research organisations, to demonstrate the potential capability of new technology.

The program's emphasis is on technology developed in Australia or New Zealand that is going to provide capability advantages for Defence and allow Australian or New Zealand industry to position itself to provide in-service capabilities and through-life support.

DSTO manages the program and provides contract management for most of the projects.

Projects contracted for Round 17 (2013-14)*

- Wideband Adaptive Interface Canceller (Ultra Electronics)
- Photonic Enhanced Radio Frequency RF Front End (University of Sydney)
- Developing Cloudlets to Support Service Oriented Architecture SOA Services (SMS)
- High Powered Rifle & Increased Fragmentation Protection (Armoured Composite Engineering)
- CEAMIST - Missile Simulation Target (CEA Technologies)
- Active Electronic Scanned Array for High Bandwidth Data Link Communications (CEA Technologies)
- SAVIOUR - Active Electronic Scanned Array for High Bandwidth Data Link Communications (Rheinmetall Simulation)
- Passive Radar (BAE Systems/Daronmont)

Projects contracted for Round 18 (2014-15)*

- Active Exhaust Silencer (University of Adelaide)
- Cryo Cooled Saphire Oscillator (CEA Technologies)
- Global Positioning System Radio Frequency GPS RF Interference Locator (GPSat Systems Australia Pty Ltd)
- Intelligent Submarine Communications Exchange Environment (Lockheed Martin)
- Miniature Modular Radio Frequency RF (BAE Systems Australia)
- Portable Reversible Hydrogen Fuel Cell (RMIT)
- Tri Band On-the-Move (EM Solutions)

**Only unclassified projects are listed.*

Appendix B: **Books published**

Nulka: A Compelling Story
Dr David Gambling, Mr Mal Crozier and Mr Don Northam (2013).

Fundamental Issues in Defense Training and Simulation (Human Factors in Defence)
Dr Christopher Best (Lead Editor), Dr George Galanis (Editor), Mr James Kerry (Editor), Dr Robert Sottilare (Editor).

High Frequency Over-the-Horizon Radar: Fundamental Principles, Signal Processing, and Practical Applications
Dr. Giuseppe Fabrizio (Author).

Modelling and Simulation: Framework of Related Standards Handbook
Prepared by Committee IT-031, Computer Modelling and Simulation, Standards Australia.

Appendix C: Public Release **science and technology reports**

Title	Author/s	Report No
A demonstration using low-kt fatigue specimens of a method for predicting the fatigue behaviour of corroded aircraft components	Bruce R Crawford, Chris Loader, Timothy, Timothy J Harrison and Quianchu Liu	DSTO-RR-0390
A detailed study of sonar tomographic imaging	H. T. Tran, B. Nguyen, R. Melino and S. Wood	DSTO-RR-0394
A model of low grazing angle sea clutter for coherent radar performance analysis	John Whitrow	DSTO-TR-2864
A review of Australian and New Zealand investigations on aeronautical fatigue during the period April 2011 to March 2013	Editor: Phil Jackson	DSTO-TN-1166
ADF Stealth Viewer user manual	Paul Crees	DSTO-GD-0745
An evaluation of new after-action review tools in Exercise Black Skies 10 & Exercise Black Skies 12	Julian Vince and Christopher Best	DSTO-TN-1216
An evaluation of potential operating systems for autonomous underwater vehicles	C. Madden	DSTO-TN-1194
An experimental investigation into the feasibility of measuring static and dynamic aerodynamic derivatives in the DSTO water tunnel	Lincoln P. Erm	DSTO-TR-2600
Analysis of high grazing angle sea-clutter with the KK-distribution	Luke Rosenberg, David Crisp and Nick Stacy	DSTO-TR-2915
Attribution of spear phishing attacks	Van Nguyen	DSTO-TR-2865
Biosecurity management of submarine niche areas: the effect of water pressure on biofouling survival	Clare Grandison and Richard Piola	DSTO-TR-2930
Blast performance of four armour materials	C. Choi, M. Callaghan and B. Dixon	DSTO-TR-2888
Casbar user's guide - version 2	Rowan J. Gollan, Brendan T. O'Flaherty, Peter A. Jacobs, Ian A. Johnston and Alan Harrland	DSTO-GD-0746
Characterisation of high grazing angle sea-clutter Doppler spectra	Luke Rosenberg	DSTO-RR-0397
Comparison of the size of ADF aircrew and US Army personnel	Peter Blanchonette and Adrian Smith	DSTO-TR-2890
Damage of concrete targets by enhanced shaped charges	A.D. Resnyansky, S.A Weckert and T.G. Delaney	DSTO-TR-2917
Detection of ionizing radiation using solar blind air fluorescence	M. D. Roberts	DSTO-TR-2842

Title	Author/s	Report No
Development of a high performing cast composite rocket propellant for booster applications	Paul C. Smith	DSTO-TR-2854
Development of a rotary wing unmanned aerial vehicle simulation model	Matthew Reid and Sylvain Manso	DSTO-GD-0791
Development of virtual blade model for modelling helicopter rotor downwash in OpenFOAM	Stefano Wahono	DSTO-TR-2931
Differential game theory application to intelligent missile guidance	Farhan Faruqi	DSTO-TR-2838
Effect of anodising on the fatigue properties of aluminium alloys	Bruce R. Crawford	DSTO-TN-1180
Evaluating the effectiveness of game-based training: A controlled study with dismounted infantry teams	S.J. Whitney, P. Temby and A. Stephens	DSTO-TR-2799
Mostly-automatic construction of a Palantir Knowledge Base with NetOwl Extractor	Matthew C. Lowry	DSTO-GD-0748
Experience with a system for manual clustering of air surveillance track data	Matthew C. Lowry	DSTO-GD-0749
Explosive line wave generators	S. A. Weckert, J. Freundt and S. Stojko	DSTO-TN-1244
Extending the wireshark network protocol analyser to decode link 16 tactical data link messages	William Robertson and Peter Ross	DSTO-TN-1257
F-111 adhesive bonded repairs assessment program - Progress report 1: Analysis of FM300 repairs	Eudora S. Y. Yeo and Andrew N. Rider	DSTO-TR-2849
Fatigue testing of the AA7050-T7451 with various corrosion prevention surface treatments	Marcus McDonald, Robert Boykett and Michael Jones	DSTO-TR-2851
Fleet sizing analysis methodologies for the Royal Australian Navy's combat helicopter replacement project	David Marlow and Ana Novak	DSTO-TR-2886
Fluidised bed microencapsulation of ascorbic acid: Effectiveness of protection under simulated tropical storage conditions	Lan Bui	DSTO-TR-2789
Future technology themes: 2030 to 2060	Nik Luketic	DSTO-TR-2877
Globally optimal path planning with anisotropic running costs	Jason R. Looker	DSTO-TR-2815
Guidance on DSTO analysis support to Australian Defence Force campaign assessment	Alison Hickman	DSTO-TN-1233
Guide on the effective block approach for the fatigue life assessment of metallic structures	Marcus McDonald	DSTO-TR-2850
High grazing angle sea-clutter literature review	Luke Rosenberg and Simon Watts	DSTO-GD-0736
How secure is the next-generation internet? An examination of IPv6	Adrian Herrera	DSTO-GD-0767

Title	Author/s	Report No
In-water treatment of biofouling in internal systems: Field validation of quaternary ammonium compound (QAC) chemical treatment protocols	Richard Piola and Clare Grandison	DSTO-TR-2774
Literature review on mental models and linear separability	Susannah J. Whitney	DSTO-GD-0741
Logic assumptions and risks framework applied to defence campaign planning and evaluation	Alison Hickman and Rebecca Karlsson	DSTO-TR-2840
Magnetic test facility - Sensor and coil calibrations	Justin Peter Dinale	DSTO-RR-0396
Medical countermeasure product development - Alternatives paper	Felicia Pradera and Malcolm Alderton	DSTO-GD-0812
Memory forensics: Review of acquisition and analysis techniques	Grant Osborne	DSTO-GD-0770
Metrology measurements of the DSTO transonic wind tunnel store support arm	Adam Blandford, John Clayton and Peter O'Connor	DSTO-TN-1247
Mobile agents for battlespace information exchange	Christos Sioutis and Yulin Ding	DSTO-TN-1179
Modelling a C-band space surveillance radar using systems tool kit	Mark Graham and Stephen Bocquet	DSTO-TN-1164
Modelling of a bi-axial vibration energy harvester	Luke A. Vandewater and Scott D. Moss	DSTO-TN-1174
Motion simulation research related short-term training attachment to TARDEC	O. Abedin	DSTO-GD-0740
Network security risks of online social networking in the workplace	Anselm Teh	DSTO-GD-0772
Nutritional composition of Australian combat ration packs and options for improvement	Bianka Probert and Lan Bui	DSTO-TR-2860
On alternative formulations for linearised miss distance analysis	Domenic Bucco and Rick Gorecki	DSTO-TR-2845
On the design of a comprehensive authorisation framework for Service Oriented Architecture (SOA)	Sarath Indrakanti	DSTO-TN-1193
Optimisation and validation of the ARAMIS digital image correlation system for use in large-scale high strain-rate events	Vanessa Pickerd	DSTO-TN-1203
Phase II experimental testing of a generic submarine model in the DSTO low-speed wind tunnel	Howard Quick and Bruce Woodyatt	DSTO-TN-1274
Probabilistic model of a floating target behaviour in rough seas	Rada Pushkarova	DSTO-TN-1196
Qualitative case study guidelines	Saša Baškarada	DSTO-GD-0773
Quality assurance of current combat ration pack components: 12 months progress report on 2010/11 ration packing program	Jeanine De Diana and Ross Coad	DSTO-TN-1173

Title	Author/s	Report No
Radio frequency signal propagation study	Elizabeth Smith	DSTO-TR-2868
Reliability, durability and packaging of fibre Bragg gratings for large-scale structural health monitoring of defence platforms	Claire Davis, Ivan Grabovac, James Kopczyk, Peter Lombardo, Patrick Norman, Anthony Rizk, Travis Nuyens and Silvia Tejedor	DSTO-TR-2880
Review of hull structural monitoring systems for Navy ships	B.P. Phelps and B. Morris	DSTO-TR-2818
Sea-spike detection in high grazing angle X-band sea-clutter	Luke Rosenberg	DSTO-TR-2820
Selecting measures to evaluate complex sociotechnical systems: An empirical comparison of a task-based and constraint-based method	David J. Crone	DSTO-RR-0395
Simulation in training workshop 2012	Ashley Stephens, Philip Temby, Greg McLean and John Hansen	DSTO-GD-0754
Simulation trial results for the cooperative autonomous underwater vehicle demonstration (SA15)	Anthony Travers	DSTO-TN-1171
Skin-friction measurements on a model submarine	M.B Jones, L.P. Erm, A. Vakiyff and S.M. Henbest	DSTO-TR-2898
Smoke flow visualisation and particle image velocimetry measurements over a generic submarine model	Peter Manovski, Matteo Giacobello and Paul Jacquemin	DSTO-TR-2944
Survey of cyber ranges and test beds	Jon Davis and Shane Magrath	DSTO-GD-0771
Survivability of a propellant fire inside a simulated military vehicle crew compartment: Part 1 – Baseline study	Andrew H. Hart, Blair Lade and Garry Hale	DSTO-RR-0392
Survivability of a propellant fire inside a simulated military vehicle crew compartment: Part 2 – Hazard mitigation strategies	Andrew H. Hart, Blair Lade and Garry Hale	DSTO-RR-0393
The Army learning organisation workshop	Steven Talbot, Denise McDowall, Christina Stothard and Maya Drobnjak	DSTO-TN-1189
The case study approach - Some theoretical, methodological and applied considerations	Mirela Stjelja	DSTO-TN-1188
The Centre for Food Innovation - research areas and potential projects	Theresa K C Hay, Paul Capela and Lan Bui	DSTO-GD-0742
The characterisation of a PEM fuel-cell system with a focus on UAS applications	James R. Harvey and Jennifer L. Palmer	DSTO-TR-2934

Title	Author/s	Report No
The DEDS: DSTO's Environmental-Data Server for research applications	Jennifer L. Palmer, John M. Wharington, Alexei T. Skvortsov, Andrew Walker and Andrew Robbie	DSTO-TR-2875
The impact of increasing acquisition costs on the operation and support budget for military equipment	Stephen Harrison	DSTO-TR-2872
The impact of stressors on performance	Diane Pomeroy	DSTO-GD-0780
The need for software architecture evaluation in the acquisition of software-intensive systems	Liming Zhu, Mark Staples and Thong Nguyen	DSTO-TR-2936
Usability evaluation of air warfare assessment & review toolset in Exercise Black Skies 2012	Julian Vince and Jessica Parker	DSTO-TR-2923
XPAR-2 search mode initial design	T.V. Cao	DSTO-TR-2904

Appendix D: DSTO papers **published or delivered externally**

Title	Author/s	Publication
3-D tomography by automated in situ block face ultramicrotome imaging using an FEG-SEM to study complex corrosion protective paint coatings	Trueman, A.R., Knight, S., Colwell, J., Hashimoto, T., Carr, J., Skeldon, P., Thompson, G.	Corrosion Science 75 376 - 385
A 6 GHz Digital Receiver Using COTS Prototyping Boards	Tsakiris, N., Hall, P., Herfurth, S.P., Tan, P., Brown, K.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013
A brief history of structural fatigue testing at Fishermans Bend Australia	Molent, L.	Advanced Materials Research 891 - 892 April 2014 106 - 114
A cladding-pumped, tunable holmium doped fibre laser	Simakov, N., Hemming, A., Clarkson, W.A., Haub, J., Carter, A.	Optics Express 21 (23) 18 November 2013 28415-28422
A column generation approach for the scheduling of patrol boats to provide complete patrol coverage	Chircop, P., Surendonk, T., van den Briel, M., Walsh, T.	In Piantadosi, J., Anderssen, R.S. and Boland J. (eds) MODSIM2013, 20th International Congress on Modelling and Simulation. Modelling and Simulation Society of Australia and New Zealand, December 2013, pp. 1110-1116. ISBN: 978-0-9872143-3-1. http://www.mssanz.org.au/modsim2013/D3/chircop.pdf
A comparison of the results for gun propellant stabiliser analysis by Markham Still and HPLC	White, A.	PARARI 2013 Australian Explosive Ordnance Symposium, Canberra, Australia, 11-14 November 2013
A discrete event simulation of the joint space cell	Mukerjee, J., Nguyen, V., Gani, R.	20th International Congress on Modelling and Simulation, Adelaide, Australia, 1–6 December 2013 www.mssanz.org.au/modsim2013 http://www.mssanz.org.au/modsim2013/D1/mukerjee.pdf
A fractographic investigation of a failed precombustion chamber nozzle from a large marine diesel engine	Davidson, L.	Advanced Materials Research 891 - 892 April 2014 75 - 80
A high frequency EMI/EMC analysis methodology for ships	Dall'Armi-Stoks, G.	IEEE EMC 2013 International Symposium on Electromagnetic Compatibility, Denver, USA, August 2013
A hybrid method for generating correlated Gamma sequences for sea-clutter simulation	Yunhan, D., Rosenberg, L., Weinberg, G.V.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013

Title	Author/s	Publication
A Kirchhoff integral approach to radar propagation over a rough sea	Coleman, C., Berry, P.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013
A many-on-many simulation framework to support the development of technology and algorithms for coordinated munitions	Anderson, P.	In Piantadosi, J., Anderssen, R.S. and Boland J. (eds) MODSIM2013, 20th International Congress on Modelling and Simulation. Modelling and Simulation Society of Australia and New Zealand, December 2013, pp. 324-330. ISBN: 978-0-9872143-3-1. http://www.mssanz.org.au/modsim2013/D1/anderson.pdf
A model for predicting the stress concentration of intergranular corrosion around a fastener hole	Harrison, T.J., Crawford, B.R., Clark, G., Brandt, M.	Advanced Materials Research 891 - 892 April 2014 242 - 247
A modified compliance method for automatically measuring fatigue crack growth in-situ during spectrum fatigue testing	Zhuang, W., Liu, Q.	Advanced Materials Research 891 - 892 April 2014 732 - 738
A multidisciplinary approach to assessing ADF operational level watch-keeping organisational design	Kalloniatis, A., Ali, I., Kohn, E., Macleod, I., Phuong, L.	Australian Defence Operations Research Review 2012, 55-73
A multipath-driven approach to HF geolocation	Fabrizio, G., Heitmann, A.	Signal Processing 93 (12) December 2013 3487-3503
A network-based approach for analysing architecture complexity of capability-based systems	Jiang, L., Seif Zadeh, H.	Systems Engineering Test and Evaluation Conference (SETE 2014), 28 April â€“ 30 April 2014
A new relocatable airglow imager	Unewisse, A., Cool, A., Meehan, D.	ASSC 13th Australian Space Science Conference, Sydney, Australia, October 2013
A review of damage tolerant design, certification and repair in metals compared to composite materials	Chowdhury, N., Chiu, W.K., Wang, J.	Advanced Materials Research 891 - 892 April 2014 1597 - 1602
A review of toxicity models for realistic atmospheric applications	Gunatilaka, A., Skvortsov, A., Gailis, R.	Atmospheric Environment 84 February 2014 230-243
A ship detection system based on the ADSS for RADARSAT-2 dual-polarisation multi-look imagery	Crisp, D.J.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013
A soft systems thinking approach to improving RAN capability measurement	Eggleton, J.	Australian Defence Operations Research Review 2012, 74-93
A tutorial on Bernoulli filters: Theory, implementation and applications	Ristic, B., Ba-Tuong Vo, Ba-Ngu Vo, Farina, A.	IEEE Transactions on Signal Processing, Volume 61, Issue 13, July 2013

Title	Author/s	Publication
An assessment of health support capabilities for amphibious operations using simulation	Gallasch, G.E., Ivanova, K.	Australian Defence Operations Research Review 2012, 20-35
Ageing characteristics of Mulwala redevelopment project comparison propellants	Hart, A., Mortimer, J., Huf, J., Sarunic, M., Prior, C., Odgers, S.	PARARI 2013 Australian Explosive Ordnance Symposium, Canberra, Australia, 11-14 November 2013
An enterprise portfolio approach for defence capability planning	Filinkov, A., Dortmans, P.J.	Defense and Security Analysis 30 (1) Janaury 2014 76-82
An experimental study of initial flaws in thin sheets of 2024 aircraft aluminium alloy	Zhuang, W., Liu, Q., Smith, C.	International Journal of Structural Integrity 5 (2) February 2014 120-128
An introduction to box-particle filtering	Gning, A., Ristic, B., Mihaylova, L., Fahed, A.	IEEE Signal Processing Magazine, Volume 30, Issue 4, July 2013
An investigation of the extent of crack closure for crack growth in an aluminium alloy	Barter, S., Burchill, M., Jones, M.	Advanced Materials Research 891 - 892 April 2014 93-99
Anaerobic whole cell biological sensors	Bereza-Malcolm, Lara T Mann, Gülay , Franks, Ashley E	Synthetic biology conference 6.0. Imperial College, London, July 2013
Anaerobic whole-cell biosensors	Bereza-Malcolm, Lara T Mann, Gülay , Franks, Ashley E	Conference for ecology and the environment. La Trobe University, November 2013
Analysis of Black Hawk main transmission support beam in-service fatigue crack	Vine, J., Jackson, P., Hu, W.	Advanced Materials Research 891 - 892 April 2014 708 - 713
Analysis of importance of brief encounters for epidemic spread	Dawson, P.	In Piantadosi, J., Anderssen, R.S. and Boland J. (eds) MODSIM2013, 20th International Congress on Modelling and Simulation. Modelling and Simulation Society of Australia and New Zealand, December 2013, pp. 324-330. ISBN: 978-0-9872143-3-1. www.mssanz.org.au/modsim2013/A5/dawson.pdf
Analysis of the performance of fuel-cell-based hybrid-electrical UAS propulsion through hardware-in-the-loop simulation	Verstraete, D., Harvey, J.R., Palmer, J.L.	ISABE 2013: 21st International Symposium on Air breathing engines, Busan, Korea, September 2013
Application of detection and recognition algorithms to persistent wide area surveillance	Fehlmann, S., Booth, D.M., Janney, P., Pontecorvo, C., Aquilina, P., Scoleri, T., Redding, N.J., Christie, R.	Proceedings of the 2013 International Conference on Digital Image Computing: Techniques and Applications
Aris-Taylor dispersion in tubes with dead ends	Dagdug, L., Berezhkovskii, A.M., Skvortsov, A.	The Journal of Chemical Physics 141 (2) July 2014 024705

Title	Author/s	Publication
Aris-Taylor dispersion with drift and diffusion of particles on the tube wall	Berezhkovskii, A.M., Skvortsov, A.T.	Journal of Chemical Physics 139 (8) 22 August 2013 084101(1-7)
Autonomous search for a diffusive source in an unknown environment	Ristic, B., Skvortsov, A., Walker, A.	Cornell University Library, arXiv:1306.1591
Autonomous search for a diffusive source in an unknown structured environment	Ristic, B., Skvortsov, A., Walker, A.	Entropy 16 (2) February 2014 789-813
Bandwidth extrapolation of LFM signals for narrowband radar systems	Nguyen, V.K., Turley, M.D.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013
Bayesian updating of aircraft risk assessments using results of inspection	Torregosa, R.F., Hu, W.	Advanced Materials Research 891 - 892 April 2014 1047 - 1052
Biaxial specimen design for structures subjected to multi-axial loads	Chowdhury, N.T., Chiu, W.K., Wang, J.	Advanced Materials Research 891 - 892 April 2014 1633 - 1638
Big data in a Defence environment	Beck, J.	UNSW 2014 Big Data Workshop, UNSW Kensington Campus, 1 July 2014
Bi-spectral IRCM-flare formulations based on tetrazole- derivatives	Brusnahan, J., Fitzgerald, M., Morgan, M., Pietrobon, R.	Propellants, Explosives, Pyrotechnics 39 (1) February 2014 133-137
Calculating crack growth from small discontinuities in 7050-T7451 under combat aircraft spectra	Jones, R., Molent, L., Barter, S.A.	International Journal of Fatigue 55 24 June 2013 178-182
Can a constellation of CubeSats create a capability? Satisfying Australia's future need for multi-spectral imagery.	Cartwright, I., Stepan, L., Lingard, D.M.	Small Satellite Conference, Utah, USA, 2013
Can pitting corrosion change the location of fatigue failures in aircraft?	Crawford, B.R., Loader, C., Liu, Q., Harrison, T.J., Sharp, P.K.	International Journal of Fatigue 61 April 2014 304-314
Case studies of fatigue failures in Defence aircraft components	Smith, S., Donnelly, D.	Advanced Materials Research, Vols 891-892, 2014, pp 81-86
Case studies of fatigue failures in Defence aircraft components	Smith, C., Donnelly, D.	Advanced Materials Research, Vols 891-892, 2014, pp 81-86
Cecil Napier Hake: Australia's first defence scientist	Kilmartin, David	Chemistry in Australia, June 2014, pp 16-19
Chalcogenide fibre-based distributed temperature sensor with sub-centimetre spatial resolution and enhanced accuracy	Vo, T.D., He, J., Magi, E., Collins, M.J., Clark, A.S., Ferguson, B.G., Xiong, C., Eggleton, B.J.	Optics Express 22 (2) 27 January 2014 1560-1568

Title	Author/s	Publication
Characterisation of a hybrid, fuel-cell-based propulsion system for small unmanned aircraft	Verstraete, D., Lehmkuehler, K., Gong, A., Harvey, J. R., Brian, G., Palmer, J.L.	Journal of Power Sources 250 March 2014 204-211
Characterization of high grazing angle X-band sea-clutter Doppler spectra	Rosenberg, L.	IEEE Transactions on Aerospace and Electronic Systems, 2014, 50(1), pp. 406-417
Classification of wave breaking mechanisms from their polarimetric radar signatures	Morris, J.T., Anderson, S.J.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013
Coaxial right/left-handed transmission line for electronic beam steering in the slotted waveguide antenna stiffened structure	Nicholson, K., Rowe, W., Callus, P., Ghorbani, K., Itoh, T.	IEEE Transactions on Microwave Theory and Techniques 62 (4) April 2014 773-778
Communication analysis for virtual mission preparation: Moving beyond simple replay	Hasenbosch, S., Ross, P.	SimTect 2013 Conference Proceedings, 16- 20 September 2013, Brisbane, Australia
Comparison of computational and semi-empirical aerodynamics tools for making fit-for-purpose modelling decisions	Abeynayake, D., Argon, A.	MODSIM2013 20th International Congress on Modelling and Simulation, Adelaide, Australia, December 2013
Computationally Fast AOA Estimation Using Sparse Large Aperture Arrays For Electronic Surveillance Radar	Ly, P. Q. C.; Elton, S. D.; Li, J. & Gray, D. A.	2013 International Conference on Radar, 2013, 526-531
Computer-based simulation of the Wayamba unmanned underwater vehicle	Madden, C., Sgarioto, D.	In Piantadosi, J., Anderssen, R.S. and Boland J. (eds) MODSIM2013, 20th International Congress on Modelling and Simulation. Modelling and Simulation Society of Australia and New Zealand, December 2013, pp. 1033–1039. ISBN: 978-0-9872143-3-1. http://www.mssanz.org.au/modsim2013/D1/madden.pdf
Congruence of joint operations - How much do we know about it?	Jiang, L., Mckay, T.	DSTO led Defence Operations Research Symposium, 2013
Constant false alarm rate detection in Pareto distributed clutter: further results and optimality issues	Weinberg, G.V.	Contemporary Engineering Sciences, Vol. 7, 2014, no. 6, 231 – 261, 2014
Constrained Fast-Time STAP for Interference Suppression in Multichannel SAR	Rosenberg, L., Gray, D.	IEEE Transactions on Aerospace and Electronic Systems, 2013, 49(3), pp. 1792-1805.
Control of an underactuated-slender-hull unmanned underwater vehicle using Port-Hamiltonian theory	Valentinis, F., Donaire, A., Perez, T.	2013 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM) Wollongong, NSW: 9 - 12 July 2013, IEEE

Title	Author/s	Publication
Corrosion-fatigue crack growth in age-hardened Al alloys: Examples of failures and explanations for fractographic observations	Byrnes, R., Goldsmith, N., Knop, M., Lynch, S.	Advanced Materials Research 891 - 892 April 2014 248 - 253
Cost effective safety from full system teardowns	Boykett, R.	Advanced Materials Research 891 - 892 April 2014 1084 - 1089
COWPATT: The value of an integrated modelling approach to designing cubesats and their missions	Stepan, L., Cartwright, I., Lingard, D.M.	ASSC 13th Australian Space Science Conference, Sydney, Australia, October 2013
Critical infrastructure modelling, simulation and analysis	Ackland, R.G., Nunes-Vaz, R.	Critical Infrastructure Modelling, Simulation & Analysis Workshop, Wollongong, Australia, October 2013
Dauphin: A new statistical signal processing language	Kyprianou, R., Moran, B., Schachte, P.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013
Decoder-assisted timing synchronization in multiuser CDMA systems	Kodithuwakku, J., Letzepis, N., McKilliam, R., Grant, A. J.	IEEE Trans. on Commun., Vol. 62, No. 6, pp. 2061-2071, June 2014
Demodulation of FM data in free-space optical communication systems using discrete wavelet transformation	Namazi, N, Burris, R, Gilbreath, GC, Suite, M, Grant, KJ,	in: A. Al-Asmari (Ed.) Discrete Wavelet Transforms - A Compendium of New Approaches and Recent Applications, InTech, 2013
Design elements of a bio-inspired micro air vehicle	Palmer, J.L., Jones, M.R., Drobik, J.	8th IFAC Symposium on Intelligent Autonomous Vehicles, Gold Coast, Australia, June 2013
Detecting anomalies from a multitarget tracking output	Ristic, B.	IEEE Transactions on Aerospace and Electronic Systems 50 (1) January 2014 798-803
Detecting speedboats in SAR imagery using polarisation synthesis	Rosenberg, L., Angelliaume, S.	European SAR Conference 2014, pp. 576-579
Detection and characterization of MIMO radar	Howard, S. D., Sirianunpiboon, S. and Cochran, D.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013, pp. 330–334.
Determination of the in-plane components of motion in a Lamb wave from single-axis laser vibrometry	Rajic, N., Rosalie, C., Norman, P., Davis, C.	Journal of the Acoustical Society of America 135 (6) 3446-3454
Developing physical capability standards that are predictive of success on special forces selection courses	Hunt, A.P., Orr, R.M., Billing, D.C.	Military Medicine 178 (6) June 2013 619-624

Title	Author/s	Publication
Development of a high performance cast composite rocket propellant for booster applications	Smith, P.C.	PARARI 2013, Australian Explosive Ordnance Symposium, Canberra, Australia, 11-14 November 2013
Development of a high performance cast composite rocket propellant for booster applications	Smith, P.C.	PARARI 2013, Australian Explosive Ordnance Symposium, Canberra, Australia, 11-14 November 2013
Development of a long range scintillometer using the angle-of-arrival technique	Clare, BA, Manning, S, Grant, KJ, Mudge, KA.	ANZCOP 2013 Australian and New Zealand Conference on Optics and Photonics Australia, Fremantle, 8-11 December 2013
Development of a passive retrodirective Van Atta array reflector at X-band	Yau, K.S.B.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013
Development of CGAP for fatigue damage and crack growth analysis: Verification, validation and examples of application	Wallbrink, C., Hu, W.	Advanced Materials Research 891 - 892 April 2014 702 - 707
Development of future space concept options using creative thinking techniques in workshops	Jakobsson, Ã	In Gaertner, P., Bowden, F., Piantadosi, J. and Mobbs, K. (eds) 22nd National Conference of the Australian Society of Operational Research (ASOR 2013), The Australian Sociaty for Operations Research, Adelaide, Australia, December, 2013. www.asor.org.au/conferences/asor2013/J3/jakobsson.pdf
Developing realism in strategic-level wargaming	Thakur, N., Boswell, S.	Australian Defence Operations Research Review 2012, 36-54
Diode-pumped wideband thulium-doped fibre amplifiers for optical communications in the 1800 - 2050 nm window	Li, Z., Heidt, A.M., Simakov, N., Jung, Y., Daniel, J.M.O., Alam, S.U., Richardson, D.J.	Optics Express 21 (22) 4 November 2013 26450-26455
Dragonfly hover is primarily mediated by vision	Chahl, J., Mizutani, A.	Bioinspiration, Biomimetics, and Bioreplication 2014, San Diego, CA: 10 - 12 March 2014, SPIE
DSTO space program	Payne, T.	ASSC 13th Australian Space Science Conference, Sydney, Australia, October 2013
Effect of laser clad repair on the fatigue behaviour of ultra-high strength AISI 4340 steel	Sun, S.D., Liu, Q., Brandt, M., Luzin, V., Cottam, R., Janardhana, M., Clark, G.	Materials Science and Engineering A 606 June 2014 46-57
Effect of load spectra and stress magnitude on crack growth behaviour variability from typical manufacturing defects	Gallagher, J.P., Molent, L.	Advanced Materials Research 891 - 892 April 2014 100 - 105

Title	Author/s	Publication
Effect of weld-induced imperfections on the ultimate strength of an aluminium patrol boat determined by the ISFEM rapid assessment method	Magoga, T., Flockhart, C.	Ships and Offshore Structures 9 (2) April 2014 218-235
Effects of adherend thickness and taper on adhesive bond strength measured by portable pull-off tests	Lee, M., Wang, C.H., Yeo, E.	International Journal of Adhesion and Adhesives 44 July 2013 259-268
Effects of body-borne equipment on occupant forces during a simulated helicopter crash	Aggromito, D., Chen, B., Thomson, R., Wang, J., Yan, W.	International Journal of Industrial Ergonomics 44 (4) July 2014 561-569
Effects of waveform and cycle period on corrosion-fatigue crack growth in cathodically protected high-strength steels	Knop, M., Birbilis, N., Lynch, S.	Advanced Materials Research 891 - 892 April 2014 211 - 216
Elastomer optimisation for high endurance vibration energy harvesting	Hart, G., Moss, S., Nagle, D.	Materials Forum
Electric discharge damage in aircraft propulsion bearings	Becker, A., Abanteriba, S.	Proceedings of the Institution of Mechanical Engineers, Part J: Journal of Engineering Tribology 228 (1) January 2014 104-113
Electronically tunable composite right / left handed transmission line for the slotted waveguide antenna stiffened structure	Nicholson, K.J., Rowe, W.S.T., Callus, P.J., Ghorbani, K.	7th International Congress on Advanced Electromagnetic Materials in Microwaves and Optics, METAMATERIALS 2013, Bordeaux: 16 - 19 September 2013, IEEE Computer Society
Endurance testing of a vibration energy harvester for structural health monitoring	Hart, G.A., Moss, S.D., Nagle, D.J., Galea, S.C.	Advanced Materials Research 891 - 892 April 2014 1261 - 1267
Enhancing layout and interaction in formal concept analysis	Pattison, T., Weber, D., Ceglar, A.	Pacific Visualisation Symposium, March 4-7, 2014, IEEE Press.
Entropy and stability of phase synchronisation of oscillators on networks	Kalloniatis, A.	Annals of Physics 348 (2014) 127-143
Estimation of Pareto clutter parameters using order statistics and linear regression	Weinberg, G.V.	IET Electronics Letters Vol. 49 No. 13, 2013
Evaluating the use of physics based modelling to support studies into reflective hyperspectral sensor target detection performance	Carr, S.B., Brady, A.C., Kharabash, S.	IGARSS 2013 International Geoscience and Remote Sensing Symposium, Melbourne, Australia, July 2013
Event triggered analogue data acquisition using the exponential moving average	Wilson, A.R.	IEEE Sensors Journal 14 (6) June 2014 2048-2055

Title	Author/s	Publication
Everyday relativity and the Doppler effect	Drake, S.P., Purvis, A.	American Journal of Physics, 2014. 82(1): p. 52-59.
Evolution of magnetic and structural properties during iron plating of carbon nanotubes	Brack, N., Kappen, P., Herries, A.I.R., Trueman, A.R., Rider, A.N.	Journal of Physical Chemistry C 118 (24) July 2014 13218-13227
EXOTIC: A small experiment on polarisation effects of oblique HF radiowaves (separating O/X modes on oblique soundings)	Harris, T., Cervera, M., Snell, A.	ASSC 13th Australian Space Science Conference, Sydney, Australia, October 2013
Experimental and modelling study of the effect of corrosion pitting on fatigue failure locations in aircraft components	Crawford, B.R., Loader, C., Liu, Q., Harrison, T.J., Sharp, P.K., Harkegard, G.	Advanced Materials Research 891 - 892 April 2014 236 - 241
Exploiting Graph Compression Techniques for Coding and Monitoring	Cheng, A., Dickinson, P.J	IEEE International Conference on Communications, ICC 2014, 10-14 June 2014,Sydney, Australia
Fast and Unambiguous Direction Finding for Digital Radar Intercept Receivers	Ly, P. Q. C.	PhD Thesis, School of Electrical and Electronic Engineering, The University of Adelaide, 2013
Fatigue crack closure due to surface roughness and plastic deformation	Walker, K., Wang, C.H., Newman, J.C., Jr.	Advanced Materials Research 891 - 892 April 2014 319 - 324
Fatigue cracking from a corrosion pit in an aircraft bulkhead	Barter, S.A., Molent, L.	Engineering Failure Analysis 39 April 2014 155-163
Fatigue life analysis of specimens subjected to infrequent severe loading using a nonlinear kinematic hardening cyclic plasticity model	Hu, W., Wallbrink, C.	Advanced Materials Research 891 - 892 April 2014 512 - 517
Fatigue life improvement of laser clad 7075 aluminium alloy by deep surface rolling technique	Liu, Q., Zhuang, W., Sharp, P.K.	Advanced Materials Research 891 - 892 April 2014 115 - 120
Fatigue of cold expanded open hole coupons with pre-existing cracks	Baburamani, P.S., Ogden, R., Liu, Q., Sharp, P.K.	Advanced Materials Research 891 - 892 April 2014 69-74
Fluid structure interaction in an interrupt bomb of propellant	Li, R.	PARARI 2013 Australian Explosive Ordnance Symposium, Canberra, Australia, 11-14 November 2013
Fluorinated aluminium nanoparticles for reactive shockwave enhancement	Tetzlaff, N., Quinton, J.S., Kuznetsov, V.	Proceedings of PARARI 2013: 11th Australian Explosive Ordnance Symposium, Canberra, Australia 11-14 November 2013
Fractographic study on the use of rainflow counting for small and long cracks in AA7050	White, P., Mongru, D.S.	Advanced Materials Research 891 - 892 April 2014 687 - 692

Title	Author/s	Publication
Full-scale manoeuvring trials for the Wayamba unmanned underwater vehicle	Sgarioto, D., Madden, C.	Underwater Technology, Vol. 32, No. 2, July 2014, pp. 67-79
Gaussian-sum Cubature Kalman Filter with Improved Robustness for Bearings-only Tracking	Leong, P., Arulampalam, S., Lamahewa, T.A., Abhayapala, T.	IEEE Signal Processing Letters, vol. 21, no. 5, pp. 513-517, May 2014
Gaussian-sum Cubature Kalman Smoother for Bearings-only Tracking	Leong, P., Arulampalam, S., Lamahewa, T.A., Abhayapala, T.	IEEE Ninth International Conference on Intelligent Sensors, Sensor Networks and Information Processing (ISSNIP), Singapore, April 2014, pp. 1-6
General transformation approach for constant false alarm rate detector development	Weinberg, G.V.	Digital Signal Processing vol 30 (2014) pp 15–26
Generation of long prolate volumes of uniform magnetic field in cylindrical saddle-shaped coils	Dinale, J., Vrbancich, J.	Measurement Science and Technology 25 (3) March 2014 035903
Generation of TIDs by atmospheric gravity waves and their effect on VI ionograms	Cervera, M., Harris, T.	ASSC 13th Australian Space Science Conference, Sydney, Australia, October, 2013
Going around in circles: A heuristic method for path categorisation	McAteer, S., Beck, J.	Australian Defence Operations Research Review 2012, 94-109
GPU-accelerated atmospheric propagation simulations	Manning, S, Clare, BA, Mudge, KA, Grant, KJ,	ANZCOP 2013 Australian and New Zealand Conference on Optics and Photonics Australia, Fremantle, 8-11 December 2013
Hardware Efficient Digital Channeliser Designs for Radar Intercept Applications	Li, J., Elton, S.D., Herfurth, S.P., Ly, P.Q.C.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013 pp 488-493
Helicopter airframe fatigue spectra generation	Krake, L.	Advanced Materials Research 891 - 892 April 2014 720 - 725
Helicopter airframe fatigue spectra truncation and verification	Vine, J., Krake, L., Krieg, B.	Advanced Materials Research 891-892 April 2014 714-719
High temporal accuracy for extensive sensor networks	Wilson, A.R., Wilson, T.E.	IEEE Sensors Journal 14 (4) April 2014 1061-1068
High-resolution monitoring of atmospheric pollutants using a system of low-cost sensors	Rajasegarar, S., Havens, T.C., Karunasekera, S., Leckie, C., Bezdek, J.C., Jamriska, M., Gunatilaka, A., Skvortsov, A., Palaniswami, M.	IEEE Transactions on Geoscience and Remote Sensing (99) 1-10 DOI: 10.1109/TGRS.2013.2276431
High-resolution wide area remote sensing for HF radar track resignation	Turley, M.D.E., Gardiner-Garden, R.S., Holdsworth, D.A.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013

Title	Author/s	Publication
Histogram PMHT unfettered	Davey, S.J., Wieneke, M., Han V.	IEEE Journal of Selected Topics In Signal Processing, Volume 7, Issue 3, June 2013
How can MBSE capture user perspectives of complex capability needs?	Knight, M., Vencel, L.	Model-based Systems Engineering Symposium, Adelaide, Australia, November 2013
Human Factors of Fratricide by Rafferty et al. [Book Review]	Baskarada, S.	ADF Journal, no. 189, pp. 113-116
Hybrid rotary-translational vibration energy harvester using cycloidal motion as a mechanical amplifier	Moss, S., Hart, G., Burke, S.K., Carman, G.	Applied Physics Letters, Volume 104, Issue 3, id 033506 (2014)
Identification and quantification of explosives in nanolitre solution volumes by Raman spectroscopy in suspended core optical fibres	Tsiminis, G., Chu, F., Warren-Smith, S.C., Spooner, N.A., Monro, T.M.	Sensors 2013, 13, 13163-13177
Impedance of a curved circular spiral coil around a conductive cylinder	Burke, S.K., Ditchburn, R.J., Theodoulidis, T.P.	NDT & E International 64 June 2014 1-6
Improved test method and analytical modelling for fatigue crack growth in coarse-grain titanium alloy with rough fatigue surfaces	Walker, K.F., Newman, J.C.	Fatigue and Fracture of Engineering Materials and Structures 37 (6) June 2014 659-670
Improving detection using a material pattern matching technique in hyperspectral images	Dawson, P., Shettigara, V.	IGARSS 2013 International Geoscience and Remote Sensing Symposium, Melbourne, Australia, July 2013
Improving the design of a human-in-the-loop joint fires experiment	Lo, E. H. S., Au, T. A., Hoek, P. J.	Proceedings of System of Systems Engineering Conference, IEEE, Adelaide, June 2014
Information security awareness: An analysis of knowledge, attitude and behaviour	Pattinson, M.R., Jerram, C., Parsons, K., McCormac, A., Butavicius, M.	Oceania CACS 2013, Adelaide, Australia, September 2013
Initial polarimetric results from the Ingara bistatic SAR experiment	Goh, A.S., Preiss, M., Stacy, N.J.S.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013
Invariance of the distributions of normalized gram matrices	Howard, S. D. Sirianunpiboon, S. and Cochran, D.	Proceedings of the IEEE Statistical Signal Processing Workshop, June 2014, pp. 1–4.
Invariant detection and estimation of MIMO radar signals	Sirianunpiboon, S., Cochran, D. and Howard, S. D.	Proceedings of the IEEE Radar Conference, RADARCON'14, May 2014, pp. 1–5.
Life extension of F/A-18 LAU-7 missile launcher housings using rework shape optimisation	Heller, M., Calero, J., Wescott, R., Barter, S., Choi, J., Surtees, G.	Advanced Materials Research 891 - 892 April 2014 739 - 744

Title	Author/s	Publication
Low frequency high resolution SAR imaging and polarimetric analysis of a Queensland tropical forest	Pincus, P.B., Preiss, M., Goh, A., Stacy, N.J.S., Gray, D.A.	IGARSS 2013 International Geoscience and Remote Sensing Symposium, Melbourne, Australia, July 2013
Low-angle target detection with interference in a multipath environment	Berry, P.E., Finch, D.P.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013
Management of interdependencies in Defence capability portfolio	Garanovich, I., de Visser, G., Nguyen, M-T., Gill, A., Ween, A., Heseltine, T., Watson, J., Taylor, R., Tailby, D., Seif Zadeh, H.	In Piantadosi, J., Anderssen, R.S. and Boland J. (eds) MODSIM2013, 20th International Congress on Modelling and Simulation. Modelling and Simulation Society of Australia and New Zealand, December 2013, pp. 1012-1018. ISBN: 978-0-9872143-3-1.
Management of interference in Pareto CFAR processes using adaptive test cell analysis	Weinberg, G.V.	Signal Processing vol 104 (2014) pp 264–273
Managing fatigue from corrosion pits in aircraft structures	Molent, L.	Advanced Materials Research 891 - 892 April 2014 261 - 266
Material scatter in crack growth rates of 7075-T7351 under spectrum loading	Hu, W., Krieg, B., Torregosa, R.	Advanced Materials Research 891 - 892 April 2014 1197 - 1202
Maximum a posteriori estimation of signal rank	Sirianunpiboon, S., Howard, S. D. and Cochran, D.	Proceedings of the IEEE International Conference on Acoustics, Speech, and Signal Processing, May 2014.
Mechanically robust, electrically conductive and stimuli-responsive binary network hydrogels enabled by superelastic graphene aerogels	Qiu, L., Liu, D., Wang, Y., Cheng, C., Zhou, K., Ding, J., Truong, V.T., Li, D.	Advanced Materials 26 (20) 28 May 2014 3333 - 3337
Microbial biosensors - a synthetic biology approach	Mann, Gülay , Franks, Ashley E	Synthetic biology and bio-engineering conference, Macquarie University, Sydney, November, 2013
Microwave radar imaging of rotating blades	Tran, H-T., Melino, R., Berry, P., Yau, D.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013
Model-based systems engineering for capability enhancement of systems of systems	Broderick, N., Waite, M., Tetlow, M.	Model-Based Systems Engineering Symposium, Mawson Lakes, 12 November 2013
Modelling and analysis of gear tooth crack growth under variable-amplitude loading	Yin, J., Wang, W., Man, Z., Khoo, S.	Mechanical Systems and Signal Processing 40 (1) 19 June 2013 105-113
Modelling of inhomogeneity in radar clutter using We ibull mixture densities	Cao, T.-T. Van	IET Radar, Sonar and Navigation, 2014, Vol. 8, Iss. 3, pp. 180-194

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Multi-objective optimisation of submarine power and energy systems	Jarvis, R., Kong, W.	Pacific 2013 International Maritime Conference, Sydney, Australia, Sydney, Australia, October 2013
Multiple target localization using wideband echo chirp signals	Leong, P., Abhayapala, T., Lamahewa, T. A.	IEEE Transactions on Signal Processing, vol. 61, no. 16, pp. 4077-4089, August 2013
Non-decision-aided detection and SNR Estimation of weak BPSK signals in AWGN	Newsam, G. and Chamalaun, M.	7th International Conference on Signal Processing and Communication Systems, ICSPCS'2013 16-18 December 2013 Gold Coast Australia, IEEE Conference Proceedings
Non-destructive Evaluation of Mechanically Loaded Advanced Marine Composite Structures	Ibrahim, M.E., Phillips, A.W., Ditchburn, R.J., Wang, C.H.	Advanced Materials Research 891-892 April 2014 594-599
Numerical simulation of the ballistic protection performance of a laminated armour system with pre-existing debonding/ delamination	Tan, P.	Composites Part B: Engineering 59 March 2014 50-59
On the concept of a transmission absorber to suppress internal resonance	Dylejko, P.G., MacGillivray, I.R.	Journal of Sound and Vibration 333 (10) 12 May 2014 2719-2734
On the CRB for frequency estimation of superimposed multidimensional sinusoids	Letzepis, N	IEEE Workshop on Statistical Signal Processing (Gold Coast, Australia), pp. 97-100, June 2014.
On the fatigue crack growth analysis of spliced aircraft wing panels under sequential axial and shear loads	Yu, X.	Engineering Fracture Mechanics 123 June 2014 116 - 125
On the fatigue durability of clad 7075-T6 aluminium alloy bonded joints representative of aircraft repair	Harman, A.B., Rider, A.N.	International Journal of Adhesion and Adhesives 44 July 2013 144-156
On the relationship between discrete and repetitive lifting performance in military tasks	Savage, R.J., Best, S.A., Carstairs, G.L., Ham, D.J., Doyle, T.L.A.	Journal of Strength and Conditioning Research 28 (3) March 2014 767-773
One, two, infinity approximate Bayes for tracking and sensor fusion	Gordon, N.	16th International Conference on Information Fusion, Istanbul, Turkey, July 2013
Operational synthesis for small combat teams: Exploring the scenario parameter space using agent-based models	Chau, W., Grieger, D.	In Gaertner, P., Bowden, F., Piantadosi, J. and Mobbs, K. (eds) 22nd National Conference of the Australian Society for Operations Research (ASOR 2013). The Australian Society for Operations Research, Adelaide, December 2013, pp. 196-203. www.asor.org.au/ conferences/asor2013/J7/chau.pdf

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Optical flow on a linear compound array	Chahl, J.	Bioinspiration, Biomimetics, and Bioreplication 2014, San Diego, CA: 10 - 12 March 2014, SPIE
Optimal non-coherent detection in K-distributed clutter environment	Yunhan, D.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013
Over-the-horizon radar continuous-wave interference suppression using harmonic least-squares fitting	Holdsworth, D.A.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013
Participative critical systems thinking applied to construction and evaluation of enhanced gap crossing capability options	Bender, A., Kayal, D.	Australian Defence Operations Research Review 2012, 1-19
Passive radar detection using multiple transmitters	Howard, S. D. and Sirianunpiboon, S.	Proceedings of the 47th Asilomar Conference on Signals, Systems and Computers, November 2013.
Passive radar processing with quantised signals	Searle, S., Palmer, J.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013
Performance prediction modelling for high resolution radar with scan-to-scan processing	Rosenberg, L., Zuk, J.	IEEE Radar Conference 2014.
Photonic technique for phase control of microwave to terahertz signals	Attygalle, M., Stepanov, D.	IEEE Transactions on Microwave Theory and Techniques,Volume 62, Issue 6, June 2014 1381-1386
Polarimetric radar studies of shoaling waves	Anderson, S.J., Morris, J.T.	IGARSS 2013 International Geoscience and Remote Sensing Symposium, Melbourne, Australia, July 2013
Polarmetric ATI slow target detection in a log likelihood framework	Stacy, N., Preiss, M.	International Geoscience and Remote Sensing Symposium (IGARSS), Melbourne, Australia, July 2013
Probabilistic risk analysis of fracture of aircraft structures using a Bayesian approach to update the distribution of the equivalent initial flaw sizes	Torregosa, R., Hu, W.	Fatigue and Fracture of Engineering Materials and Structures 36 (11) 25 July 2013 1092-1101
Probabilistic vibration analysis of a mistuned Integrally bladed disk	Chen, G., Hou, J.	Advanced Materials Research 891 - 892 April 2014 726 - 731
Project plan and literature review, final year research project - Radar simulation	Gregory, D.	University of South Australia's School of Engineering Honours Program
Propagation Models for body area networks: A survey and new outlook	Smith, D. B., Miniutti, D., Lamahewa, T. A. and Hanlen, L. W.	IEEE Antennas and Propagation Magazine, vol. 55, no. 5, pp. 97-117, October 2013

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Pseudo fatigue testing for rapid certification to service	Molent, L., Barter, S.A., Gordon, M., Weibler, L.	Advanced Materials Research 891 - 892 April 2014 1059 - 1064
Range and egomotion estimation from compound photodetector arrays with parallel optical axis using optical flow techniques	Chahl, J.S.	Applied Optics 53 (3) 20 January 2014 368-375
Rare-event simulation for radar threshold estimation in heavy-tailed sea clutter	Zuk, J., Rosenberg, L.	IEEE Statistical Signal Processing Workshop 2014, pp. 468-471.
Resonance versus aerodynamics for energy savings in agile natural flyers	Kok, J.M., Chahl, J.	Bioinspiration, Biomimetics, and Bioreplication 2014, San Diego, CA: 10 -12 March 2014, SPIE
Review on the fatigue of composite hybrid joints used in aircraft structures	Chowdhury, N., Chiu, W.K., Wang, J.	Advanced Materials Research 891 - 892 April 2014 1591 - 1596
Robust performance prediction modelling for compound distributions with temporal correlation	Rosenberg, L., Bocquet, S.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013
Rotational energy harvesting from a drive shaft for structural health monitoring	Payne, O., Moss, S.	ACAM8-ABS-1204
Sampling based estimation of DQPSK transmission bit error rates with Nakagami-m Fading Channels	Weinberg, G.V.	International Journal of Communications (IJC) Volume 2 Issue 2, June 2013
Satisfying Australia's future need for multi-spectral imagery using a cubesat solution	Cartwright, I.J.R., Stepan, L.B., Lingard, D.M.	Proceedings of the 12th Australian Space Science Conference, Melbourne, 24 - 26 September, 2012, Published by the National Space Society of Australia Ltd, Editors: Wayne Short and Iver Cairns ISBN 13: 978-0-9775740-6-3
Scaling of electromagnetic vibration energy harvesting devices	Moss, S., Payne, O., Hart, G.	Proc. of SPIE Vol. 9057 9057-28 (2014)
Scattering phenomena of edge guided waves at and around notches	Nadarajah, N., Vien, B.S., Chiu, W.K., Rose, L.R.F.	Advanced Materials Research 891 - 892 April 2014 1249 - 1254
Sea-spike detection in medium grazing angle X-band sea-clutter	Rosenberg, L.	IEEE Transactions on Geoscience and Remote Sensing, 2013, 51(8), 2013, pp. 4556-4562.
Semi-empirical model for ionospheric absorption based on the NRLMSISE-00 atmospheric model (SiMIAN)	Pederick, L., Cervera, M.	ASSC 13th Australian Space Science Conference, Sydney, Australia, October 2013

Title	Author/s	Publication
Service fatigue cracking in an aircraft bulkhead exposed to a corrosive environment	Barter, S.A., Molent, L.	Engineering Failure Analysis 34 12 August 2013 181-188
Shock sensitivity of composition B in improved wedge test	Kuznetsov, V.A., Mellen, P., Lu, J.P.	Proceedings of PARARI 2013, 11th Australian Explosive Ordnance Symposium, 11-14 November Canberra, Australia
Smoothed finite element and genetic algorithm based optimization for shape adaptive composite marine propellers	Herath, M.T., Natarajan, S., Prusty, B.G., St. John, N.	Composite Structures 109 (1) 22 October 2013 189-197
SNR limits on Kalman filter detect-then-track	Davey, S.	IEEE Signal Processing Letters, Volume 20, Issue 8, August 2013
Statistical clustering of drifting buoy trajectories around Japan and off Fukushima to identify Lagrangian circulation features	Hamilton, L.J.	Statistical clustering of drifting buoy trajectories around Japan and off Fukushima to identify Lagrangian circulation features. Methods In Oceanography (2013) 6, 16-32.
Statistics of chemical tracer concentration in a multicompartment structure measured with a sensor network	Karunasekera, S., Skvortsov, A., Gunatilaka, A., Pitaliadda, D.	In Piantadosi, J., Anderssen, R.S. and Boland J. (eds) MODSIM2013, 20th International Congress on Modelling and Simulation. Modelling and Simulation Society of Australia and New Zealand, December 2013, pp. 1089-1095. ISBN: 978-0-9872143-3-1. www.mssanz.org.au/modsim2013/D2/karunasekera.pdf
Strength and sintering effects at ejection of explosively driven sand	Resnyansky, A.D., Weckert, S.A.	APS-SCCM & AIRAPT-24 Joint Conference, Seattle, USA, July 2013
Student assignment Powerpoint presentation radar simulation	Gregory, D.	University of South Australia's School of Engineering Honours Program
Success factors for urgent technology insertion into military systems of systems	Baskarada, S.	9th International Conference on System of Systems Engineering (SOSE), Adelaide, Australia, June 9-13.
Survivability of a propellant fire inside a military vehicle crew compartment: numerical investigation	Harrland, A., Johnston, I., Hart, A.	PARARI 2013 Australian Explosive Ordnance Symposium, Canberra, Australia, 11-14 November 2013
Synthetic biology – Engineering bacteria to act as environmental sentinels	Bereza-Malcolm, Lara T , Mann, Gülay, Franks, Ashley E	Conference for ecology and the environment, La Trobe University, November 2013
Synthetic phenolic antioxidants in middle distillate fuels analyzed by gas chromatography with triple quadrupole and quadrupole time-of-flight mass spectrometry	Webster, R.L., Rawson, P.M., Evans, D.J., Marriott, P.J.	Energy and Fuels 28 (2) 15 January 2014 1097-1102

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Testing various backtracking algorithms in airborne maritime surveillance modelling	Marlow, D., Murphy, J.	In Piantadosi, J., Anderssen, R.S. and Boland J. (eds) MODSIM2013, 20th International Congress on Modelling and Simulation. Modelling and Simulation Society of Australia and New Zealand, December 2013, pp. 1040-1046.
Technology deployment process model	Baškarada, S, McKay, T, McKenna, T	Operations Management Research, vol. 6, no.3-4, pp. 105-118
The effect of crack growth retardation when comparing constant amplitude to variable amplitude loading in an aluminium alloy	Burchill, M., Barter, S., Jones, M.	Advanced Materials Research 891 - 892 April 2014 948 - 954
The Effect of manufacturing defects on the fatigue behaviour of Ti-6Al- 4V specimens fabricated using selective laser melting	Liu, Q., Elambasseril, J., Sun, S., Leary, M., Brandt, M., Sharp, P.K.	Advanced Materials Research 891 - 892 April 2014 1519 - 1524
The effects of DVB-T SFN data on passive radar signal processing	Capria, A., Conti, M., Moscardini, C., Petri, D., Palmer, J., Searle, S.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013
The influence of mechanical and chemical treatments on the environmental resistance of epoxy adhesive bonds to titanium	Brack, N., Rider, A.N.	International Journal of Adhesion and Adhesives 48 January 2014 20-27
The Pareto distribution for high grazing angle sea-clutter	Rosenberg, L., Bocquet, S.	IGARSS 2013 International Geoscience and Remote Sensing Symposium, Melbourne, Australia, July 2013
The role of microstructure in the stress relaxation and tempering of laser clad Ti-6Al-4V	Cottam, R., Luzin, V., Liu, Q., Mayes, E., Wong, Y.C., Wang, J., Brandt, M.	Materials Science and Engineering A 601 April 2014 65-69
Three-dimensional characterisation and simulation of deformation and damage during Taylor impact in PTFE	Resnyansky, A.D., McDonald, S.A., Withers, P.J., Bourne, N.K., Millett, J.C.F., Brown, E.N.	APS-SCCM & AIRAPT-24 Joint Conference, Seattle, USA, July 2013
Tracer dispersion in the turbulent convective layer	Skvortsov, A., Jamriska, M., Dubois, T.C.	Journal of the Atmospheric Sciences 70 (12) Dec 2013 4112-4121
Track-before-detect on quantised intensity maps	Cheung, B., Davey, S.J.	IEEE RADAR 2013 International Conference on Radar, Adelaide, Australia, September 2013
Unifying monotonic and hysteresis material properties for notch plasticity analysis under variable amplitude loads	Yu, X., Liu, Q., Wallbrink, C.	Advanced Materials Research 891 - 892 April 2014 500 - 505

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User created tangible controls using ForceForm: A dynamically deformable interactive surface	Tsimeris, J., Stevenson, D., Adcock, M., Gedeon, T., Broughton, M.	26th Annual ACM Symposium on User Interface Software and Technology, UIST 2013, St. Andrews, Scotland: 8 - 11 October 2013
Using cognitive models in applied settings: A sequential sampling model of the Unmanned Aerial Vehicle Operator	Vuckovic, A., White, D., Boag, R., Martin, R.	Australian Mathematical Psychology Conference, Australian National University, Canberra, Australia February 2014
Using discrete-event simulation to predict the size of a fleet of naval combat helicopters	Marlow, D., Novak, A.	In Piantadosi, J., Anderssen, R.S. and Boland J. (eds) MODSIM2013, 20th International Congress on Modelling and Simulation. Modelling and Simulation Society of Australia and New Zealand, December 2013, pp. 1117-1123.
Using scan-statistical correlations for network change analysis	Cheng, A., Dickinson, P.J.	Trends and Applications in Knowledge Discovery and Data Mining Lecture Notes in Computer Science Volume 7867, 2013, pp 1-13
Vibration energy conversion device (II)	Moss, S., Hart, G.	Australian Patent Application 2013254931
Vibration energy harvesting using a spherical permanent-magnet	Moss, S., Hart, G., Burke, S.K., Galea, S., Carman, G.	Proc. of SPIE Vol. 9057 9057-27 (2014)
VX and VG chemical warfare agents bidentate complexation with lanthanide ions	Dennison, G., Sambrook, M.R., Johnston, M.R.	Chemical Communications 50 (2) 28 November 2013 195-197
Weld-end solidification cracking in pulsed-tandem gas metal arc welding of naval steels	Sterjovski, Z., Bayley, C., Donato, J., Lane, N., Lang, D.	Welding Journal 93 (5) May 2014 145-152

Appendix E: **Patents granted**

Patent Title	Inventors	Country	PatentAppNo	FilingDate	PriorityDate	GrantNo	GrantedDate
Firearm Sighting Device for Viewing Around Obstacles	Chapman, T	"Europe* (France, Germany, United Kingdom)"	04797038.9	11/05/2006	18/11/2003	1692454	7/08/2013
Messaging Method	Wang, J	Canada	2609863	5/06/2006	3/06/2005	2609863	18/02/2014
Matrix Compression Arrangements	Wang, J	Canada	2610467	30/11/2007	3/06/2005	2610467	11/03/2014
Messaging Method - Divisional	Wang, J	Singapore	201003736-4	27/05/2010	5/06/2006	162730	31/10/2013
Monitoring the Structural Health of Mechanical Components	Wong, A	Australia	2008215172	11/08/2009	14/02/2007	2008215172	12/09/2013
A Clamp and Wrapping Assembly for Patching a Pipe Rupture	Robinson, J	New Zealand	592937	19/11/2009	19/11/2008	592937	3/12/2013
Testing Mechanical Components for Wear and Tear	Gerrard, D	New Zealand	593510	9/06/2011		593510	28/01/2014
Digital Video Guard	North, CJG., Beaumont, MRG., Yiu, KKH., Green, JD	United States of America	13/126444	24/12/2009	24/12/2008	8572403	29/10/2013
Digital Video Guard	North, CJG., Beaumont, MRG., Yiu, KKH., Green, JD	New Zealand	592063	1/04/2011	24/12/2008	592063	4/06/2014
Apparatus for Metallic Particulate Quantification	Becker, A	United States of America	13/118734	31/05/2011	31/05/2011	8601886	10/12/2013

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Dr Dragana Calic, inaugural DSTO science advisor to Joint Task Force 633 at Camp Baird, UAE.

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